

Dairy Products Processing Level-II



**Based on September, 2021, Version 3 Occupational
Standards (OS)**

Module Title: Operating a Packaging Process

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Introduction to the Module

This module covers to provide the trainees with the skills and knowledge required to set up, operate, adjust and shut down a packaging process or sub-system since Packaging is science, art and technology of enclosing or protecting products for distribution, storage, sale, and use.

LG #42

LO 1: Prepare the Equipment and Process for Operation

Instruction sheet-1

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 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 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. If you earned a satisfactory evaluation proceed to “Operation Sheets.
6. Perform “the LAP Test” which is placed following “Operation sheets”.
7. If your performance is satisfactory proceed to the next Learning Guide.

Information Sheet-1

1.1 Confirming and making available packaging component, materials and items

1.1.1 Definition of Packaging

Packaging refers to the protection of products of 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 the science, art and technology of enclosing or protecting products for distribution, storage, sale, and use. 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 profits.

1.1.2 Forms of packaging

Packaging may be looked at as several different types. For example a transport package or distribution package is the package form used to ship, store, and handle the product or inner packages. It is sometimes convenient to categorize packages by layer or function: "primary", secondary", etc. There are different forms of packaging based on the packaging material used.

i. Primary packaging:

It 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. A primary package is one that comes into direct contact with the contained product, e.g., metal cans, glass jars, and plastic pouches. Primary packages should have the following characteristics to facilitate the sale of products:

- Sanitary
- Non toxic
- Transparent
- Light weight
- Tamper evident

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- Easy to pick up and handle
- Display the product

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ii. Secondary packaging

It is outside the primary packaging – perhaps used to group primary packages together (E.g. Paper board pack containing butter wrapped in parchment paper).

iii. Tertiary packaging

It is used for bulk handling, warehouse storage and transport shipping. The most common form is a palletized unit load that packs tightly into containers (E.g. Boxes containing 20-25 or 50 Butter packs are put together).

iv. Quaternary packaging

This is as methods of handling and transportation have become more sophisticated, the palletized unit loads in tertiary packaging may be packed into large metal containers, i.e., quaternary packaging for transportation over long distances by air, land, or sea. The secondary, tertiary and quaternary packaging is also known as packing.

Table 1.1 Differences between packaging and packing

S.N.	Packaging	Packing
1	Come in direct contact with the product	Never come in direct contact
2	Called primary packaging material	Called secondary / tertiary / quaternary
3	Food grade, non-toxic, tasteless, odourless,	No strict requirements
4	Packaging is must	May/not be done. Packaging then packing
5	Materials used: Plastics, glass, metal, treated paper or their combination	Plastic board boxes, wood, metal, etc. Shrink/stretch wrapping

6	Objectives: Mainly to contain, carry, protect. Help in selling, legal aspects, technical,	Mainly ease in transportation and protection of packages
7	Recycled material never used	Much preferred
8	Keeping quality is determined by packaging material.	Generally not so

1.1.3 Function and importance of Packaging

Technical packaging professionals need science and engineering skills, while marketing professionals need artistic and motivational understanding.

Table 1.2 Functions of packaging

Technical Functions		Marketing Functions	
Contain	Measure	Communicate	Promote
Protect	Dispense	Display	Sell
Preserve	Store	Inform	Motivate

The basic functions required of a package can be grouped under five major categories.

1.1.3.1 To Contain the Product (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.

1.1.3.2 To Protect the Product (Quality, Safety, Freshness)

One of the most important function 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.

Generally packaging can prevent or protect the product from;

- Physical damage,

- Material loss,
- Moisture loss or gain, dust, and light which causes product deterioration.
- Temperature fluctuations in the transit of chilled and frozen foods.
- Microbial spoilage by bacteria, yeasts, and molds.
- Microbiological spoilage of stored products due to rodents and insects.
- Damages which may be due to various hazards.

1.1.3.3 Medium of communication (Labels)

An important function of any food package is to identify the product and its origin; to inform the consumer how to use the contents; to provide any other information needed or required; and very importantly, to attract the user and encourage purchase of the product.

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

- Product manufacturing and best buy dates,
- Proper storage conditions,
- Utilization instructions,
- Size and number of servings or portions per pack,
- Nutritional information per serving,
- Manufacturer's name and address,
- Information transmission- Packages and labels communicate how to use, transport, recycle, or dispose of the package or product.

1.1.3.4 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. Foods can be processed where they are grown, waste is treated at the processing plant, and shipping weights are reduced, thereby lowering the cost of transportation.

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1.1.3.5 Means of selling product

The packaging and labels can be used by marketers to encourage potential buyers to purchase the product. Packaging is often referred to as the silent salesman.

1.1.4 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.

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1.1.4.1 Characteristic of an ideal packaging material

Good packaging material should have the following characteristics;

- Compatible with product.
- Protecting from mechanical hazards.
- Having advertising potential.
- Having attractive appearance.
- Having proof for moisture, grease, oil, etc.
- Economical and easily available, etc.

1.1.4.2 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,
- Socio-economic situation of the expected customer or market,
- Cost of the packaging material, etc.

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

Table 1.3 Reasons 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, light weight
Rejection			
Water absorption possibility	Shatters	Corrodes	Thermal limit
Penetrable	High weight-to strength ratio	Limits shapes	Permeable/water absorption
Image	Limited shapes	Appearance	Absorbs flavors
Punctures	Large sizes	Flavor, distortion	Distortion and leaving shape

A. Glass Containers

Glass makes impermeable containers that are easy to open and reclose. It is inert and thus it is safe to store food and drinks. Glass is 100% recyclable and can be recycled endlessly with no loss in quality or purity. Glass recycling is a closed loop system, creating no additional waste or by-products. In most countries, bottles and other glass containers are either returned to be refilled or are recycled at a high rate. Glass is one of the most important packaging materials because of its high barrier and see-through properties.

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.
- Potentially serious hazards arise from glass fragments in foods.

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Figure 1.1 Glass containers

A. 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. In the dairy sector metal is used in a few applications, like cans for condensed milk and milk powders, and aluminium foils for butter.

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.

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- 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 1.2 Metal and tin plate steel containers

B. Plastics Containers

Multiple types of plastics are being used as materials for packaging food, including polyolefin, polyester, polyvinyl chloride, polystyrene, polyamide, and ethylene vinyl alcohol. Polyolefins and polyesters are the most common. Plastic containers have the following benefits over other packaging materials;

- Good Versatility/ flexibility,

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- Plastic containers are light weight, flexible, has strength, less breaking,
- Cost is comparatively lower than glass and metal containers,
- Consumer's convenience at lower cost,
- Ease in transportation and distribution,
- Plastics are non-corrosive,
- Plastics can be recycled.

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Figure 1.3 Plastic containers

C. Paper Containers (Cardboards)

Paper is made from cellulose, trees being the main source of cellulose fiber or wood pulp, cotton, hemp, manila and jute. Paper and cardboards 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.

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Figure 1.4 Paper and wooden and cardboard boxes Containers

1.1.5 Types of Packaging methods

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

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

Mainly there are three types of Packaging. These are;

1.1.5.1 Vacuum packing (Vacuum sealing)

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

Vacuum packing is a form of packaging that involves the removal of air from a pouch or plastic container. The single most important reason for creating a vacuum is to remove oxygen from around the thing that we are going to store because of air is made up of about 21% oxygen.

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



I

Figure 1.5 Zhejiang cheese vacuum packaging forming machine parmesan mozzarella butter block thermoforming packing machine

<https://www.youtube.com/watch?v=0XxzwHsPJGQ> Vacuum butter packaging machine

There are two types of Vacuum packing machines; these are:

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

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Figure 1.6 a External Bag Machines



Figure 1.6 b Vacuum Chamber Machines

1.1.5.2 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. 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.

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.
- **Compensated Vacuum:** Here, vacuum is first applied to remove the air and then the desired gas or gas mixture is incorporated.

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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 odor.
- Potential shelf-life increases by 50- 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.

Basically packaging materials used for MAP technology include glass and metal containers and semi-rigid and plastic containers.



Figure 1.7 MAP trays Sealer packaging machine
<https://youtu.be/oQJI0MTIm6s> dairy processing plant

1.1.5.3 Blister packaging (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.

1.2 Identifying and confirming cleaning and maintenance requirements

1.2.1 Definition of 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.

1.2.2 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 and may limit the use of certain chemicals for safety reasons.

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

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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. 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 and it should be applied in an even layer.

d. Machine washing

This is normally an automatic or semi-automatic washing process conducted within a purpose built machine. 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.

1.2.3 Cleaning procedure

Cleaning is a complex process. 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:

- i. Gross clean /Preparation
- ii. Pre-rinse
- iii. Detergent application
- iv. Post-rinsing
- v. Disinfection

1.2.4 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.

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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.

1.3 Fitting and adjusting machine components and related attachments

1.3.1 Components of a custom filling machine

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

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i. 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.

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.

ii. 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.

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.

iii. Product pathway

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.

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.

iv. Nozzles

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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.



Figure 1.8 MK-101-Vertical Form Fill Seal packaging machine for Powder
<https://www.youtube.com/watch?v=rJF0bcYORTE>

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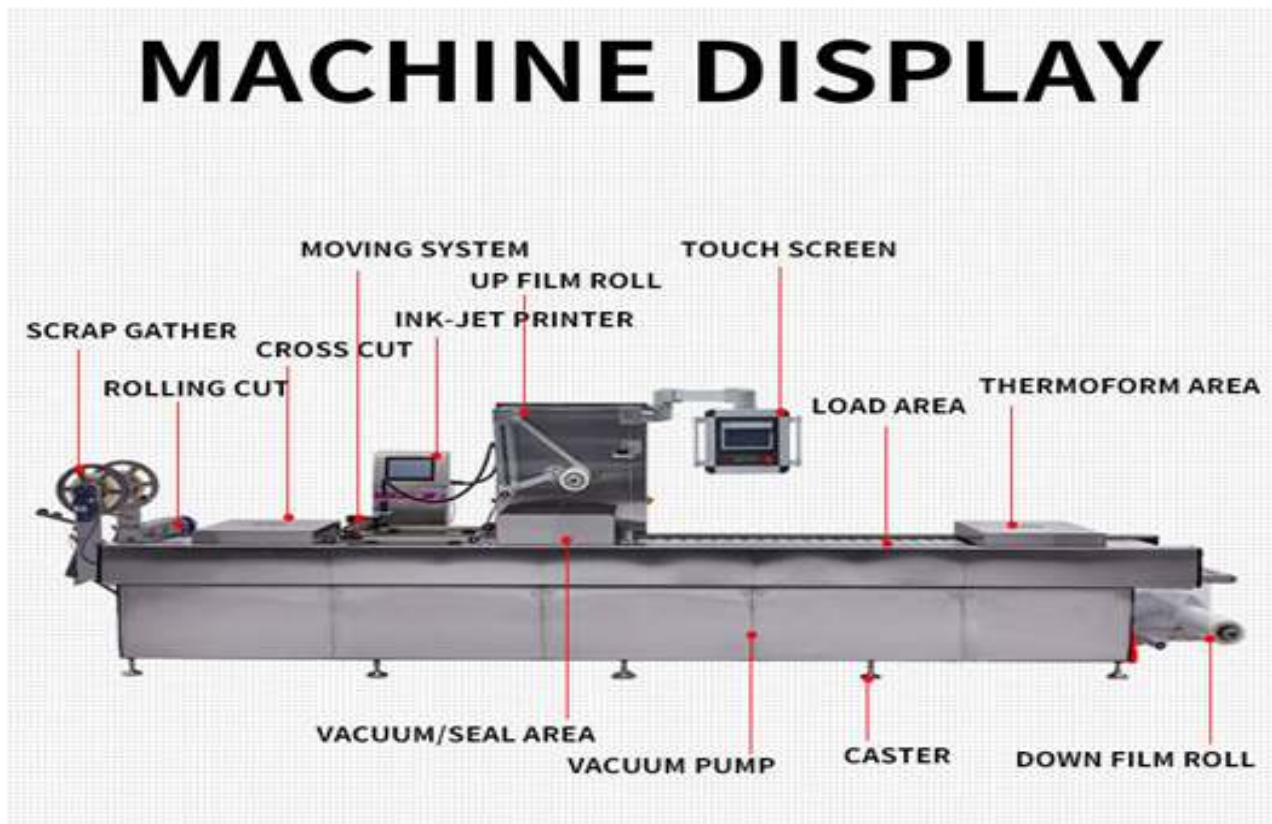


Figure 1. 9 Zhejiang cheese vacuum packaging forming machine parmesan mozzarella butter block thermoforming packing machine

1.3.2 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.

1.3.3 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.

1.3.4 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.

1.4 Entering processing/operating parameters

Operation procedures of packaging equipment 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 and deteriorations in the required product.

These operation procedures of packaging aim to:

- Increase employee awareness on the safe use of equipment;
- Ensure that work equipment is suitable for the purpose for which it is to be used;

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

During entering operating parameters to meet safety and production requirements, the following points should be assessed and addressed.

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

The other Operating parameter should cover material safety data sheet (MSDS) which 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 correctly set-up for processing;
- Process monitoring and recording;
- Monitoring and recording of key process parameters like temperature, pressure etc.;
- Sampling of raw materials, products and effluent;
- Packaging of final product.

1.5 Loading material, product and packaging components

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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.

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 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,
- Packing with appropriate packaging material,
- Store in a suitable storage room to minimize quality deterioration on products.

1.6 Checking and adjusting equipment performance

1.6.1 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 a measure of a piece of the system but not necessarily an overall view of how effective the equipment is.

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Every piece of packaging machinery has an ideal cycle time that is 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)

It 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 that is 100% loading.

1.6.2 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).

1.7 Carrying out pre start checks

In an industry, there are many types of works to be operated like machines and laboratory operations and before going to operate machine, we have to 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, etc.)

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- Identify faulty conditions.
- Identify the possible hazards.
- Check it is complete, with all safeguards fitted, and free from defects.
- Follow manufacturer specification.
- Maintenance as required to prevent risk.
- Make sure the machine/ equipment is safe for work.

A checklist used to in pre- and post-operation equipment inspection includes;

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

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.

Part I: Choose the best answer (10 points)

2. Which one of the following packaging material is cost effective?

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- A. Plastic B. Glass C. Metal Cans D. Aluminum cans
3. Which one of the following is not importance of packaging?
A. Protect the product B. Medium communication C. Increase cost D. Containment
4. ----- is a packaging material that first envelops the product and holds it.
A. Quaternary packaging B. Tertiary packaging C. Primary packaging D. None
5. Primary packages should have the following characteristics, except:
A. Sanitary B. Toxic C. Easy to pick up and handle D. Display the product
6. Which one of the following is ideal Characteristic of packaging materials?
A. Compatible with product C. Advertising potential
B. Protection from hazards D. All

Part II: Short Answer Questions (10 points)

1. What is the main purpose of safety checks? (2 points)
2. Write down Components of a custom filling machine. (2 points)
3. What are the things in which the machine operators will be always have to check just before going to manipulate operations? (3 pts)
4. List and discuss in detail what you have to do during performing the Pre-operation Equipment Inspection on a machine.(3 pts)

Note: Satisfactory rating 10 points Unsatisfactory- below 10 points

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

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Operation Sheet-1

1.1 Fitting and adjusting Zhejiang cheese vacuum packaging forming machine components and related attachments

A. Tools, equipment and machines required

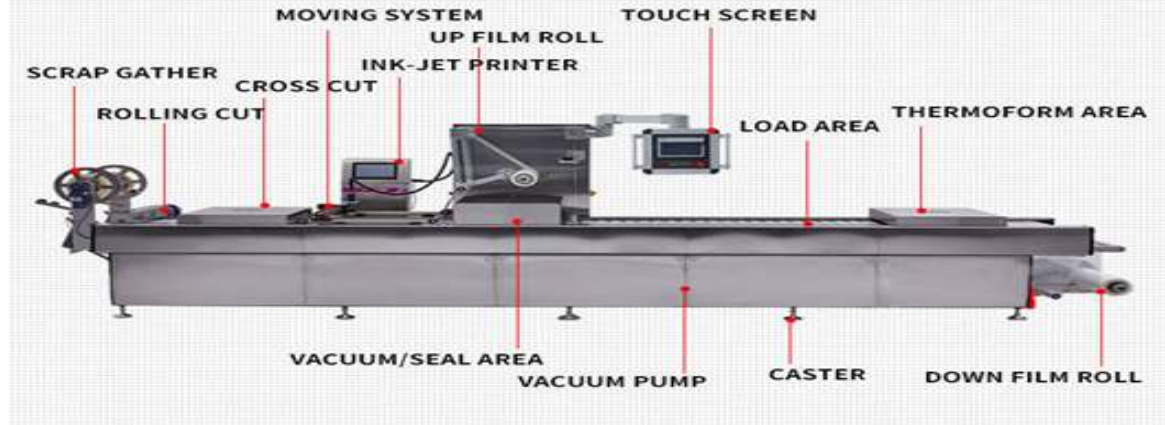
- Personnel protective equipments
 - ✓ Gloves
 - ✓ Shoes
 - ✓ Face mask
 - ✓ Gown/Overall
- Packaging machines (Fiiler, Sealler,)
- Hand tools like screw

B. Procedure

- 1 Wear appropriate personal protective equipments.
- 2 Identify the packaging machine to be fitting and adjusting.
- 3 Differentiate different parts of machine.
- 4 Identify faulty and unfit parts of the machine.
- 5 Adjust part of the equipment identified.
- 6 Test the machine.
- 7 Record results.



MACHINE DISPLAY



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Operation Sheet-1

1.2 Conducting pre-start check of Zhejiang cheese vacuum packaging forming machine

A. Tools, equipment and machines required

- Personnel protective equipments
 - ✓ Gloves
 - ✓ Shoes
 - ✓ Face mask
 - ✓ Gown/Overall
- Packaging machines to be check
- Power source
- Testing tools like power tester

B. Procedure

1. Wear appropriate personal protective equipments.
2. Identify the available packaging machines.
3. Clean each component of the equipments.
4. Disconnect the power of the machine.
5. Check for damage on machine parts and maintain faulty parts.
6. Adjust or assemble part of the equipment identified.
7. Test the machine.
8. Record results.

LAP Test-1	Performance Test
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Name: ID: Date:

Time started: _____ Time finished: _____

Instruction: Given necessary templates, tools and materials you are required to perform the following tasks within **5:30 hour**. The project is expected from each trainee to do it.

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

Task-2: Conducting pre-start check of packaging equipment in packaging operation.

LG #43

LO 2: Operate and Monitor the Process

Instruction sheet-2

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 reporting Out-of-specification 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
- Identify, rectify and report Out-of-specification process outcomes
- Maintain work area
- Conduct Packaging work
- Maintain workplace records

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. If you earned a satisfactory evaluation proceed to “Operation Sheets.
6. Perform “the LAP Test” which is placed following “Operation sheets”.
7. If your performance is satisfactory proceed to the next Learning Guide.

Information Sheet-2

2.1 Starting and operating packaging process

2.1.1 Select, fit and use personal protective clothing

Every type of packaging requires certain personal protective equipment to keep workers safe and minimize product contamination. There also need absorbents to handle any spills or messes that are caused by spilled products, leaks from machines, and more. Closed loop recycling has all the solutions you need to stay safe and save money.

Components of Personal Protective Equipment (PPE);

- Gloves.
- Gowns.
- Shoe and Head Covers.
- Masks and Respirators.
- Other Face and Eye Protection.

2.1.2 Packaging of Dairy products

The shelf life of milk and milk products depend upon;

- The product and the packaging system used,
- The specifications of packaging material, and
- The storage conditions in which it is held.

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2.1.2.1 Cheese Packaging

The steps used for processed cheese packaging are:

- a. Prepare cheese to be packed
- b. Processed cheese slicer/cutter: A cheese knife is a type of kitchen knife specialized for the cutting of cheese. Different cheeses require different knives, according primarily to hardness. There are also a number of other kitchen tools designed for cutting or slicing cheese, especially the harder types.

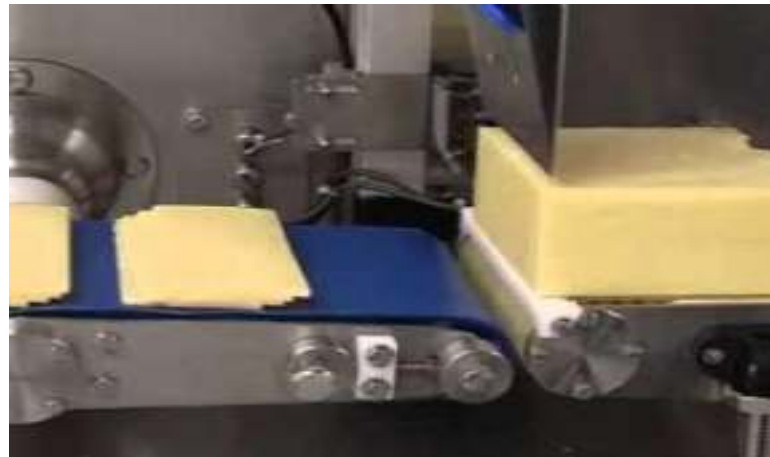


Figure 2.1 Cheese Slicer Machine

- c. Conveyor: In the wake of framing bundling boxes, it is gone through a conveyor to the filling station. Sliced processed cheese is likewise passed on there.

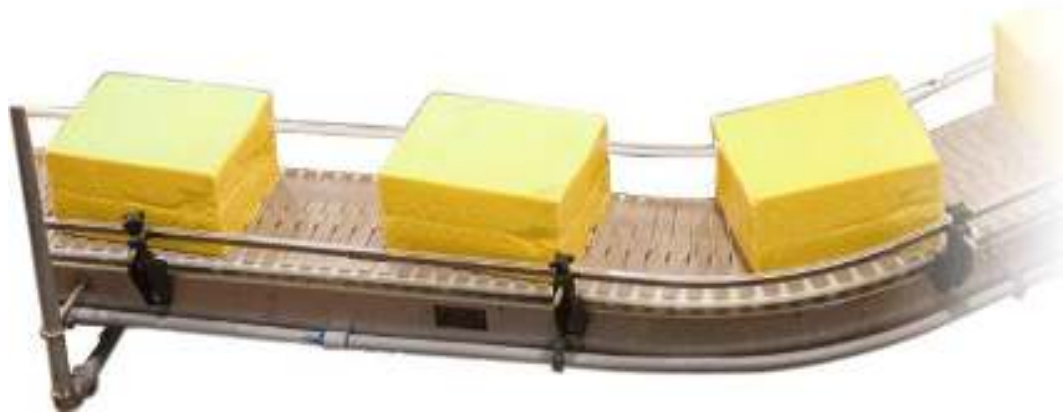


Figure 2.2 Conveyor

d. Filling Station: Using a pick and place robot to fill the processed cheese slices into the box.



Figure 2.3 Pick and place robot filling machine

e. Sealing Machine: Automatic box sealing machine can be used for this purpose. The capacity of this machine is 40 to 48 boxes per minute.

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Figure 2.4 IDEA PACK's automatic tray sealing machine

- f. Lid Labeling: BOPP is used as lid. For BOPP lid labeling automatic BOPP labeling machine can be used, for this study KPK-4PC model is used.



Figure 2.5 BOPP labeling machine

- g.** Coding: Coding is necessary to know the manufacturing and expiring date and furthermore to know the details of product through barcode or QR code. For this purpose, automatic inkjet coding machine can be used.



Figure 2.6 Automatic inkjet coding machine

- h.** Cartooning: Automatic cartoon erector can do 10-12 cartons forming and tapping in every minute very efficiently and conveniently. Carton board can be loaded without stopping the machine. Packaging line will not stop during the continuous packaging flow. A cartooning machine (cartoner) is a packaging machine that produces cartons by erect, folded, close, side seamed and sealed cartons.

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Figure 2.7 a Cartoning Machine Figure 2.7 b Fully integrated automatic cartoning machine

- i. Palletizer: The function of this system is to pick the completed boxes up (processing) and put them down on the pallet for transportation.



Figure 2.8 Palletizing Machine

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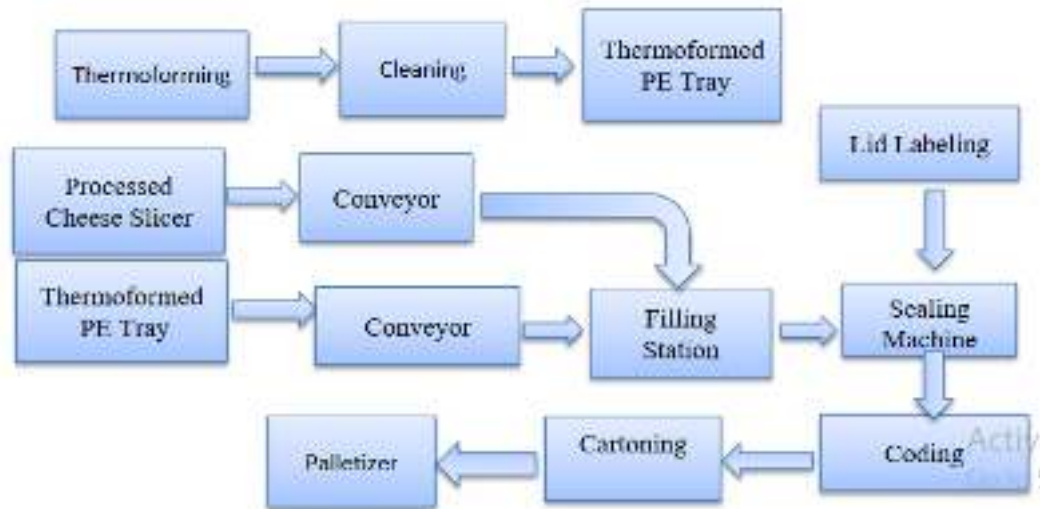


Figure 2.9 Flow chart of Cheese Packaging line station



Figure.2.10 Complete cheese processing packaging
<https://youtu.be/kzNjmixpse8>

2.1.2.2 Blister Packaging of Butter

Butter packing may be accomplished in bulk or retail packs. The shelf-life of the bulk butter may be extended considerably by storing it in frozen conditions at below 18 °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 include:
 - ✓ 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.
- Techniques of butter packaging may be;
 - ✓ Manual moulding and wrapping,
 - ✓ Mechanical moulding and hand wrapping,
 - ✓ Fully automatic units



Figure 2.11 Butter Packaging machine

<https://www.youtube.com/watch?v=0XxzwHsPJGQ>

<https://www.youtube.com/watch?v=r5FEWP5Uinc>

2.1.2.3 Packaging of fluid Milk

Packaging material required for fluid milk packaging should be;

- It should be free from off-flavours.
- It should act as barrier to bacterial contamination,
- It should have no physiological effects on the products.
- It should be tamper proof.
- It should be economical.



Figure 2.12 Fluid milk packaging
https://www.youtube.com/watch?v=xmHHNA7_p2A
<https://www.youtube.com/watch?v=T5LxO-8gFzk>

2.1.2.4 Packaging of Yoghurt

Yoghurt has become very popular in many nations and it is packed in coated paper board containers. A polystyrene tub is an excellent package for yoghurt. It is economical, practical and widely used. Yoghurt is also being sold in expanded polystyrene foam tubs in trays.



Figure. 2.13 Yoghurt packaging

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<https://youtu.be/QqNezoWBfkU>

2.2 Monitoring operating 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;

2.2.1 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.



Figure 2.14 Food conveying systems in the plant

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<https://previews.123rf.com/images/279photo/279photo1603/279photo160300200/53401438-dairy-plant-conveyor-with-milk-bottles-in-food-factory.jpg>

2.2.2 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.



Figure 2.15 Filling machine

<https://www.shutterstock.com/image-photo/bottling-plant-water-line-processing-600w-1174793467.jpg>

2.2.3 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.

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Figure 2.16 Milk product Sealing

<https://www.alamy.com/stock-image-milk-processing-plant-167446226.html?imageid=E18BC2B2-55CE-463D-8B76-AA1826BA0590&p=534617&pn=1&searchId=c92589cc51296b0f2a00d81f3be4d75a&searchtype=0>

2.2.4 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.

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Figure. 2.17 Butter wrapping process

<https://media.istockphoto.com/id/1192961024/photo/piece-of-butter-isolated-on-white-background.jpg?s=1024x1024&w=is&k=20&c=m0ScET-O8lxCnExx1UmyFKDXJ3wvqJW7SHU4p4oZuXE=>

2.2.5 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.

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Figure 2.18 Case packers machine

<https://shleadworld.en.made-in-china.com/product/RyGmtusAawkP/China-High-Speed-Automatic-Bottle-Case-Packing-Milk-Case-Packer-Drop-Down-Carton-Packer-Machine.html>

2.2.6 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.

2.2.7 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;

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- 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.



Figure. 2.19 Ink jet coders for milk product

<https://ec-pack.en.made-in-china.com/product/YKWEgPyuYMcn/China-Barcode-Printer-Continuous-Inkjet-Coding-Printer-for-Milk-Box-EC-JET500-.html>

2.2.8 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

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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.

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
- Usage instructions, etc.



Figure 2.20 Automatic labeling machines

https://www.alibaba.com/product-detail/mineral-water-way-milk-bottle-labeling_62259598036.html#

2.2.9 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 2.21 Milk product Palletizes

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<https://www.youtube.com/watch?v=npUFQEf7jPc>

2.2.10 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 2.22 Milk product Shrink wrappers machine

https://img.directindustry.com/images_di/photo-g/216475-15131423.webp

2.3 Identifying and reporting Variation in equipment operation

2.3.1 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.

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- 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 report faults and any identified causes in accordance with workplace procedures.
- Follow machine manufacturers manual.

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2.3.2 Steps of corrective action in response to variations

ii. Define the Problem

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

iii. 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.

iv. 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.

v. 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.

vi. 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.

2.4 Monitoring the Process

In monitoring the process of packaging based on specifications of dairy product packaging process should be proceed in accordance with work place procedures, operation procedures, and should meet specifications.

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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.

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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 via the shelf life of the product.
- An assurance that the packaging will withstand the special environmental conditions.

2.5 Identifying, rectifying and reporting Out-of-specification process outcomes

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 two phases.

a. Phase I investigation

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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.

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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.

2.6 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,

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- Floors should be strong enough to support loads placed on them.

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 their eyes to see.

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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

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.

2.7 Conducting packaging work

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 at a workplace must ensure the following:

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- 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 site amenities and facilities are:

- Designed and installed according to company legislative and requirements
- 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.

2.8 Maintaining workplace record keeping

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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-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.

Part I: Choose the best answer (6 points)

1. The type and method of packing depends on;

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- 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 (14 points)

1. Write common Gases used in Modified atmosphere packaging (5 points).
2. Mention the two types of Vacuum Packing Machine (5 points).
3. Write the importance of recording? (4 points)

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

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

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Operation Sheet-2

1.1 Operating cheese packaging process;

A. Materials, tools and equipments required

- PPEs
 - ✓ Gloves
 - ✓ Shoes
 - ✓ Face mask
 - ✓ Gown/Overall
- Materials and tools required;
 - ✓ Cheese to be packed
 - ✓ Cartoon
 - ✓ Plastic
 - ✓ Cardboard
 - ✓ Glass
- Packing machines;
 - ✓ Processed Cheese Slicer
 - ✓ Conveyor
 - ✓ Filling machine
 - ✓ Sealing Machine
 - ✓ Lid Labeling machine
 - ✓ Coding machine
 - ✓ Cartooning material
 - ✓ Palletizer machine

B. Procedures

1. Wear appropriate personal protective equipment

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2. Processed cheese slicer.
3. Filling by

Operation Sheet-2

 using sealing machine.
4. Sealing by

Operation Sheet-2

 using automatic box sealing machine.
5. Lid-labeling by using labeling machine.
6. Coding by using automatic inkjet coding machine.
7. Cartooning by using a cartooning machine (cartoner).
8. Palletize to pick the completed boxes up and put them down on the pallet for transportation using Palletizing machine.
9. Clean different dimensional machine parts used for packaging.

1.2 Operating butter packaging process;

A. Materials

- PPEs;
 - ✓ Gloves
 - ✓ Shoes
 - ✓ Face mask
 - ✓ Gown/Overall
- Materials and tools;
 - ✓ Butter to be packed
 - ✓ Cartoon
 - ✓ Plastic

- Packing machine;
 - ✓ Conveyor
 - ✓ Lid-labeling machine
 - ✓ Cartoning material
 - ✓ Palletizer machine

B. Procedures;

1. Wear appropriate personal protective equipments.
2. Prepare all necessary materials, tools and equipments.
3. Identify the possible machine for butter packaging.
4. Check the functionality of machines for undertaking butter packaging.
5. Operate butter packaging process.
6. Labeling packed product.
7. Properly store packed products.
8. Clean different dimensional parts of a machine used for packaging.

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LAP Test-2	Performance Test
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Name:ID: Date:

Time started: _____ Time finished: _____

Instruction: Given necessary templates, tools and materials you are required to perform the following tasks within **6:00 hour**. The project is expected from each trainee to do it.

Task-1: Operating Cheese packaging process.

Task-2: Operating Butter packaging process.

LG #44

LO 3: Shut down the Process

Instruction sheet-3

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. If you earned a satisfactory evaluation proceed to “Operation Sheets.
6. Perform “the LAP Test” which is placed following “Operation sheets”.
7. If your performance is satisfactory proceed to the next Learning Guide.

Information Sheet-3

3.1 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:

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- 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.

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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.

3.2 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 (Remove)

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.

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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.

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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.

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.

3.3 Identifying and reporting maintenance requirements

3.3.1 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,

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- Lubricating,
- Tightening
- Simple tool repairs and adjustments.

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3.4 Types of maintenance

i. Preventive or proactive maintenance

It is carried out to keep something functional and it is an activity which is usually planned and scheduled.

ii. Corrective or reactive maintenance

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

iii. 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.

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- 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.

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Table 3.1 Maintenance check list

S.N	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?			

3.5 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 3.2 Documenting and report maintenance

S.No.	Date	Equipment	Maintenance Check points	Maintenance Required	Signature

1					
2					
3					

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.

Part I. Give short answer (15 points)

1. Mention the types of shut down (5 points).
2. Mention the types of maintenances (5 points).
3. List at least three maintenance equipment may done (5 points).

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

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

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Operation Sheet -3

3.1 Shut downing Zhejiang cheese vacuum packaging forming machine safely;

A. Materials, tools and equipments;

- PPEs;
 - ✓ Gloves
 - ✓ Shoes
 - ✓ Face mask
 - ✓ Gown/Overall

- Packaging machines

B. Procedures;

1. Wear appropriate personal protective equipment's.
2. Identify the possible packaging machine to shut down.
3. Disconnect the power source.
4. Follow proper shutdown of manufacturing guide line or manual.
5. Clean the machine.

LAP Test-3	Performance Test
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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 Zhejiang cheese vacuum packaging forming machine safely.