Alcoholic and Non AlcoholicBeverage Processing- Level-II

Based on October, 2019, Version 2 Occupational standards

Module Title:- Operating a Packaging and labeling Process

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LG #41	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 available Packaging and labeling materials /equipment
- identifying maintenance requirements
- confirming Services and utilities
- fitting and adjusting equipment and instrumentation components,
- setting Operating parameters
- loading & positing of packaging materials ,products and components
- checking and adjusting Equipment performance

Checking functionality of equipment

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 available Packaging and labeling materials /equipment
- identify maintenance requirements
- confirm Services and utilities
- fit and adjust equipment and instrumentation components,
- setoperating parameters
- load& positing of packaging materials ,products and components
- check and adjust equipment performance

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

Information Sheet 1- Confirming available Packaging and labeling material /equipment

1.1. Introduction

This module covers the knowledge, skills and attitude required to set up, operate, adjust and shut down a packaging process or sub-system. The right selection of packaging materials and technologies maintains product quality and freshness during distribution and storage. Packaging is defined as a mean or system by which a fresh produce or processed product will reach from the production center to ultimate consumer in safe and sound condition at an affordable price. Packaging fresh fruits and vegetables is one of the more important steps in the long and complicated journey from grower to consumer. Materials that have traditionally been used in food packaging include glass, metals (aluminum, foils and laminates, tinplate, and tin-free steel), paper and paperboards, and plastics. Moreover, a wider variety of plastics have been introduced in both rigid and flexible forms. Today's food packages often combine several materials to exploit each material's functional or aesthetic properties. As research to improve food packaging continues, advances in the field may affect the environmental impact of packaging.

Definitions of terminologies

Packaging is described / defined in various ways:

- 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.
- Packaging may be defined as 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 is a means of ensuring safe delivery of the product to the ultimate consumer in sound condition at minimum cost.
- Packaging is a techno-economic function aimed at minimizing costs of delivery while maximizing sales (and hence profits).
- Packaging is described as 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 an all-embracing term and covers the operation of cleaning, giving protective coating, weighing and filling, closing, labeling, surface designing, printing, cartooning and bracing, containerizing, marketing and may also include material handling.
- Packaging is defined as 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.

The packaging requirements

The packaging requirements for all types of beverages are:

- Absolutely leak-proof and prevent contamination
- Protect the contents against chemical deterioration
- No pick up of external flavours
- Be hygienic and safe
- Retain carbonation in the case of carbonated beverages
- Economical, easy to use and dispose
- Good aesthetic appearance

Key parameters to be considered when selecting a packaging system are:

- Process
- Distribution, shelf-life requirements, legislation
- Product composition and quality as produced and at full shelf-life
- Product protection required during storage, distribution and retail sale
- Pack size, printing options, display etc.
- Packing system concept, automation options, ability to integrate with existing and/or future systems
- Consumer appeal, image of product and packing

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

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.

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. Packaging can prevent physical damage.

Medium of communication (Graphics, 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 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.

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. The handling of packages in quantity is important for the economics of bulk storage, warehousing, transport, and distribution.

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. Packages can have features which add convenience in distribution, handling, display, sale, opening, reclosing, use, and reuse. Primary packages should have the following characteristics to facilitate the sale of products:

- ✓ Sanitary
- ✓ Non toxic
- ✓ Lightweight
- ✓ Easy to pick up and handle
- ✓ Display the product, etc.

1.2. Packaging materials

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

Packaging materials include:

- Glass containers
- Plastic containers: can, Bottles Pet, plastic pouchand Aseptic Packages
- Paper /carton box
- Metal can
- vacuum packing one way valve packing
- aluminium foil packing
- aluminium can packing
- shrink packing
- modified atmosphere packaging (MAP)
- blister packaging or over wrapping filled bottles and
- crocked bottle

1.2.1. Glass Containers

Glassgenerally 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. Many glasses contain silica as their main component and glass former.

Glass containers used in food packaging are often surface-coated to provide lubrication in the production line and eliminate scratching or surface abrasion and line jams. 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.

Figure 1: glass container

Characteristics 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.

The disadvantages of glass as a packaging container are:

- 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.

1.2.2. Metal can packages

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.It can block air and light so as to prolong the shelf life of drinks. Metal can has good mechanical property. It is resistant to high-temperature, high-moisture, high-pressure, insect-pest, and harmful substance. Metal hand is hard to break. It is easy to take, and meet today's life style. Metal can be well decorated to promote sales. Metal can be melt and recycled.Metal packages also have some drawbacks: poor chemical stability and alkali resistance. If the interior paint has low quality, it would contaminate the drinks. It is necessary to upgrade the technology, improve the product quality, and solve the problem of break and leakage.

Aluminum foil provides a complete barrier to light, oxygen, moisture and bacteria.For this reason, foil is used extensively in food and pharmaceutical packaging. Aluminum foil is also used to make aseptic packaging. This type of packaging enables storage of perishable goods without refrigeration.

Aluminum Cans

Aluminum is attractive, light, and strong, but requires lot of energy and raw materials to produce the packaging cans. The majority of cans of soft drinks, lids, foils etc are made from aluminum.

Advantages of aluminum:

- In comparison to tin plate, Aluminum is lighter and more ductile
- Lower transportation costs, thus economical.
- It has a good weight-strength ratio
- It has a high quality surface for decorating or printing.
- Easier to recover or recycle
- More resistant to corrosion as compared to tin plate.
- It is pleasant to handle.
- Aluminum is non-toxic, odorless and does not have metallic taste.

Figure 2: Metal can packages

1.2.3. Plastic Containers

Fruit juices contain organic substances, which are sensitive to bacterial contamination. Packaging of such products is done through hot filling, to achieve extended shelf-life; pet bottles are usually used for hot filling applications. Special features are added to the containers through design and manufacturing process. The package is heat-set in order to improve the temperature resistance of the containers. Pet resins with a higher glass transition temperature and/or a faster rate of crystallization are used.

Advantages 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

1.2.4. Aseptic Packages

Ready to serve fruit beverages and fruit pulps / concentrates, packed in aseptic packages provide excellent protection for fruit juices / pulps. These aseptic packages are made by combining thermoplastic with paperboard and aluminum foil. Their multi-layered construction enables the carton to protect the contents from various factors responsible for spoilage. The aluminum foil layer is a strong barrier for O2 and light. The inner plastic layer made of polyethylene makes it possible to seal through the liquid. The outer paper layer provides stiffness making it possible for the cartons in a brick shape, thus, enabling maximum utilization of available storage and transportation space. Excellent graphics are possible leading to good display and shelf appeal and also providing information regarding the product. The aseptic process makes the product bacteria-free before being packaged.

Figure 3: Fruit Drinks in Aseptic Packs

1.2.5. Bottle packages

Glass bottle is resistant to heat, low temperature, pressure, and cleaning. It is usually used for fruit tea, jujube juice, and those with high requirement on the containers. Glass bottle has good barrier property, heat resistance, low cost, and convenience for recycle. It can meet the requirements of beer to prevent microbial pollution, carbon dioxide and water loss. Therefore, most beers and wines are packaged in glass bottles. On the other hand, glass containers also have some defects: it has heavy weight, easy to break, high transportation cost, uneasy to print. Therefore, most commercial drinks don't use glass bottle any more.

Figure 4: Glass bottle

Glass bottles have the following advantages:

- non-toxic
- odourless
- transparent
- beautiful
- good barrier
- airtight
- rich in raw materials
- low priceand
- easy to recycle

1.2.6. Paper carton packages

Paper containers are usually used for the package of fruit and vegetable juice, milk, and soft drink. It can be classified into papers, brick composite paper box, paper cup, and composite can. Paper packages have the advantages of low cost, light weight, convenience for transportation, no metal dissolving or can smell.

Paper packages can be recycled easily, so it is environmentally friendly. But their pressure resistance and air tightness is lower than glass bottle, metal can, and plastic container. Besides, paper packaged drinks cannot be sterilized under high temperature.

The paper cartons are made of high-strength paper boards. They are paper composite materials. They are widely used in fruit juice, teas, coffee, especially milks.Paper packages have taken over large market space of glass bottles, but it is impacted by pet bottles. Paper packages still play an important role in the drink market, especially in small-capacity packing. It is reported the sterile carton packing consumption is more than 100 billion every year, which is mainly contributed by people in developed countries.

Figure 5: Paper package

1.3. Types of packaging

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

Packaging includes:

- vacuum packing
- Modified Atmosphere Packaging (MAP)
- blister packaging or over wrapping

1.3.1. Vacuum packing

Vacuum packing 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. Shrink film is sometimes used to have a tight fit to the contents. The intent of vacuum packing is usually to remove oxygen from the container to extend the shelf life of foods and, with flexible package forms, to reduce the volume of the contents and package.Vacuum packing reduces atmospheric oxygen, limiting the growth of aerobic bacteria or fungi, and preventing the evaporation of volatile components.

Figure 6:vacuum packer

1.3.2. Modified atmosphere packaging (MAP)

Food packaging is in which the earth's normal atmosphere has been modified to extend a food's shelf life. A gas mix typically utilizing carbon dioxide, nitrogen, and oxygen gases. Products are packed in a single gas or a combination of three gases, depending on the spoilage mechanism of the food item. There are a number of ways to slow down these processes of spoilage and to keep food attractive and edible for as long as possible. These include simple refrigeration the lower the temperature the slower most microbes will grow or treatments such as pickling, curing with salt or by adding artificial preservatives.

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

Figure 7: Modified atmosphere packaging

1.3.3. Blister packaging or over wrapping

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

Figure 8: Blister packer

1.4. Labeling Requirements

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

- The name of the food
- List of ingredients
- Quantitative ingredients declaration (where indicated)
- Net contents and drained weights

- Name and address
- The country of origin
- Lot identification
- Date marking and storage instructions
- Instructions for use and special storage requirement
- General script
- Nutrition labeling

Self-check 1	Written test

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 advantage of packaging?

   A. Protect the product B. Medium communication C. Minimize cost **D. All**

3. 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 (3 points each)

1. Define packaging. (3 points each)
2. Elaborate dairy packaging materials. (5 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 - 5 points Unsatisfactory - below 5 points

Information Sheet 2- Identifying and confirming cleaning and maintenance Requirements

Cleaning

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

Cleaning Methods

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

Manual cleaning

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

Foam cleaning

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

Figure 9: **Foam cleaning**

Spray

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

Fogging

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

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.

Cleaning in place (CIP)

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

of the product contact surfaces under conditions of increased turbulence and flow velocity.

Cleaning procedure

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

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

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

Legal cleaning requirements

Compliance regarding cleaning of food premises

Make sure that:

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

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.

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

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

2.5.1 Types of maintenance

Basically there are two types of maintenance:-

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

2.5.2 Perform maintenance safely

Always disconnect powered tools before servicing, adjusting, oiling, cleaning or repairing them, sharpening or changing accessories such as blades.

- Follow the manufacturer's instructions in user's manual for maintenance and servicing (e.g. lubrication, cleaning) and changing parts and accessories.

- Use appropriate tools and equipment while carrying out maintenance
- When maintenance is complete workers have to check if the maintenance has left the portable tools in a safe and functioning condition:
- Replace all guards and safety devices
- Record your inspection and actions, sign out and pass the tool to the worker or store it safely

Self-Check – 2	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions

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

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

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

Information Sheet 3: Confirming services availability

Services availability

In order to undertake mead maturation process there must be an accessibility of infrastructures to undertake the maturation process successfully. Before conducting the task confirming the availability and functionality of different services is very important. Since operating the mead maturation process without available services is difficult. Among different services, the most frequently required services are electrical power, water accessibility, gas, steam, compressed air and refrigerator. These services are very critical to carryout mead maturation process and to maintain the quality of mead or honey-wine. Therefore, identifying and confirming the availability of these services before conducting the operation is mandatory as to maintain the quality of the product (honey-wine).

Electrical accessibility (Power)

Electrical accessibility is very critical in mead maturation process specifically controlling the temperature of the mead, conditioning, clarification, fining the product. In general to carryout mead maturation process, electrical power accessibility is very important.

Accessibility of water

Accessibility of water is also very important and critical for dissolving, cooling and for different cleaning activities in mead maturation process. Thus, water must be freely accessible in the workplace area.

Compressed air

Air compressor is also the most important equipment in mead maturation process. At the start of each process, air compressors pull air in from the surrounding atmosphere, creating the pressure that is key in nearly every process moving forward. The next part of the process involves pushing liquid from one tank through piping while maintaining ideal conditions along the way.

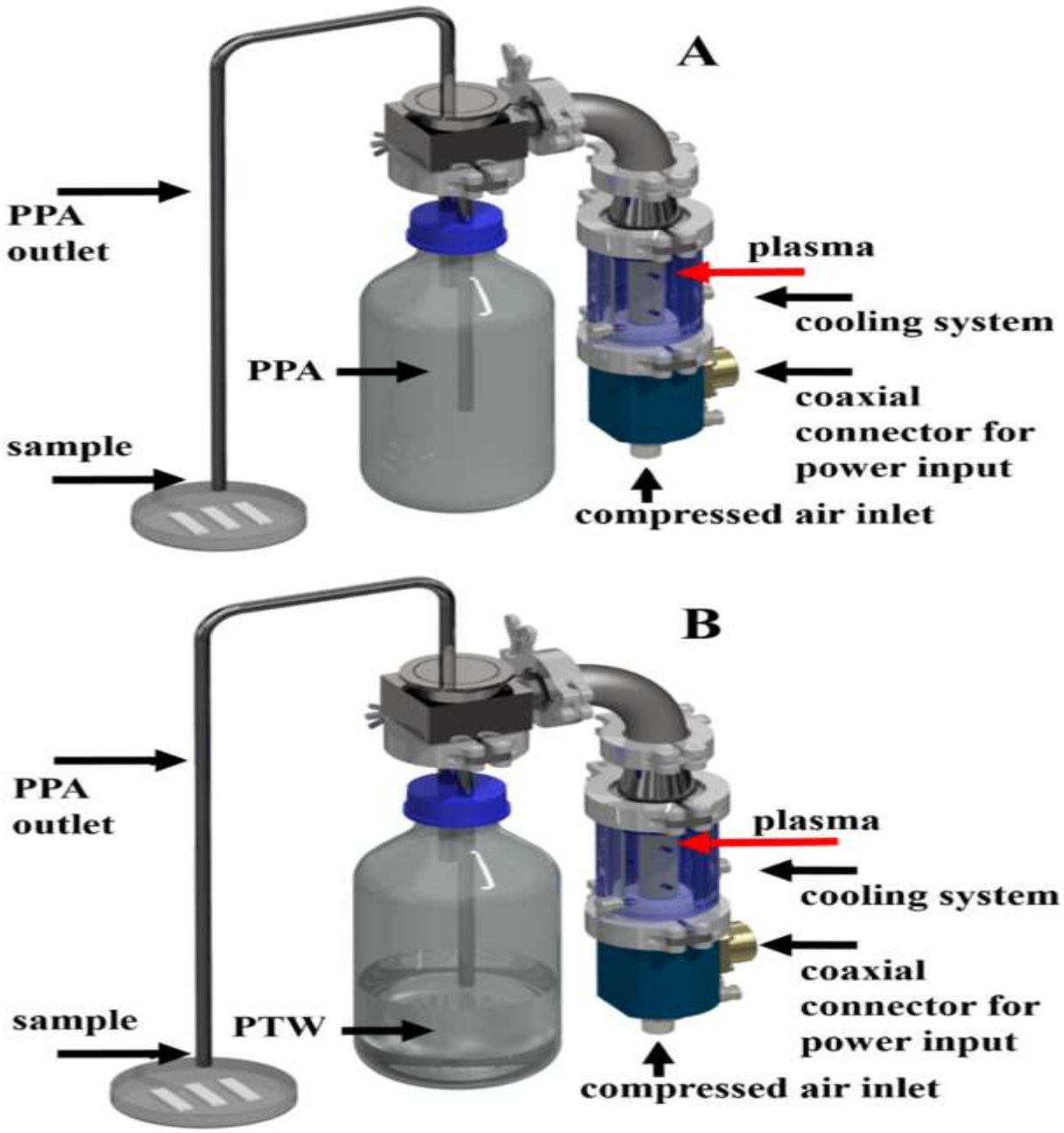

Figure 10: Air Compressor

Inert gas:is one of the best solutions for controlling oxygen exposure to aging wine. It protects the wine from oxygen and keeps the wine freshness, sherry-like aromas and flavors, and volatile acidity production.

Figure 11: Inert gas system

Steam

Steam is an efficient and effective energy medium which is widely used in brewery industry for wine maturation process. Steam heat plays an integral role in brewery.

Figure 12: Steam machine

Information Sheet 4- Fitting and adjusting machine components and related attachments

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.

Safety check

Check and make sure there is no foreign matter on:

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

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.

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.

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.

Self-Check – 4	Written test

Name…… ID……. Date…….

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

Test I: Short Answer Questions

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

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

Information Sheet 5- setting Operating parameters

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

N.B: 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 – 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. 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 6- Loading material, product and packaging components

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.
  - ✓ Pumping ‘new’ product into ‘old’ should be avoided for oxidative quality reasons.
  - ✓ 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-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 (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 7- Checking and adjusting equipment performance

Checking equipment performance of different packaging machineries in packaging and labeling of different beverage products is mandatory as to maintain the quality of the products.

Evaluation of performance of packaging machinery

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

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. An OEE of 100% means that only good parts are produced (100% quality), at the maximum speed (100% performance), and without interruption (100% availability). Measuring OEE is a manufacturing best practice. By measuring OEE and the underlying losses, important insights can be gained on how to systematically improve the manufacturing process. OEE is an effective metric for identifying losses, bench-making progress, and improving the productivity of manufacturing equipment (i.e., eliminating waste).

Total effective equipment performance (TEEP)

Total effective equipment performanceis 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). It is not however an absolute measure and is best used to identify scope for process performance improvement, and how to get the improvement.

Overall equipment effectiveness measurement is also commonly used as a key performance indicator (KPI) in conjunction with lean manufacturing efforts to provide an indicator of success.

Factors Affecting Overall Equipment Effectiveness

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)

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

Performance

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

In the packaging equipment world, a changeover is adjusting a machine to accommodate different products. Changeovers mean the machine is offline and not producing, which equals money down the drain.

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. 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 8- Carrying out pre start checks

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.

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

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

Conduct Checks on Machine/Equipment

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

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

- Also look at the residual risks identified by the manufacturer in the information/instructions provided with the machine and make sure they are included in the safe system of work.
- Choose the right machine for the job.
- Make sure the machine/ equipment is:
  - ✓ safe for any work that has to be done when setting up, during normal use, when clearing blockages, when carrying out repairs for breakdowns, and during planned maintenance;
  - ✓ Properly switched off, isolated or locked-off before taking any action to remove blockages, clean or adjust the machine.

The Pre- and Post-Operation Equipment Inspection Checklist

- Clear any accumulated debris from the equipment's.
- Check signs of damage.
- Check for leaking or pooled fluid around and under the machine.
- Check for new signs of structural damage, scratches or dents on the machine.
- Inspect the operator compartment and clear away any debris or obstructions.
- Familiarize yourself with the control style and change as needed.
- Identify auxiliary/attachment controls.
- Start the power and review console indicators and warnings.
- Review all external surroundings.

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 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 - 1	Conduct cleaning and sanitizing equipments

Conduct cleaning and sanitizing equipments in packaging operation

1. Wear appropriate personal protective equipment's
2. Prepare necessary cleaning and sanitizing materials and tools such as detergents sanitizers, soap, brush, sponge, etc
3. Identify packaging equipments to be cleaned and sanitized
4. Make sure whether machines are working or not
5. Observe all parts of the machine or equipment
6. Clean every parts of the machine
7. Sanitize the machine
8. Record the result of the operation
9. Recommend preventive measures

Operation Sheet - 3	Adjusting machine parts

Adjusting packaging machine parts

1. Wear appropriate personal protective equipment
2. Identify the packaging machine
3. Make off the power of the machine
4. Inspect the machine components
5. Identify faulty and unfit parts of the machine
6. Adjust part of the equipment identified
7. Test themachine
8. Record results

N.B

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

LG #18	LO #2- 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 process
- Monitoring equipment operating variation
- Reporting equipment maintenance requirement
- Monitoring packaging process
- Identifying out of specification process outcomes
- maintaining housekeeping standards
- applying work environmental guidelines
- maintaining work place 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 process
- Monitor equipment operating variation
- Report equipment maintenance requirement
- Monitor packaging process
- Identify out of specification process outcomes
- maintain housekeeping standards
- apply work environmental guidelines
- maintain work place 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”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.

4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance 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, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Starting and Operating Process

The process of packaging and labeling is starting and operating according to workplace procedures. Packaging is the last stage prior to warehousing and delivery. This process also has become highly automated. Meeting various marketplace requirements, bottles or cans enter the packaging machinery and may be wrapped with cardboard to form cases or placed into reusable plastic trays or shells. The packaged products then enter a palletizing machine, which automatically stacks them onto pallets.

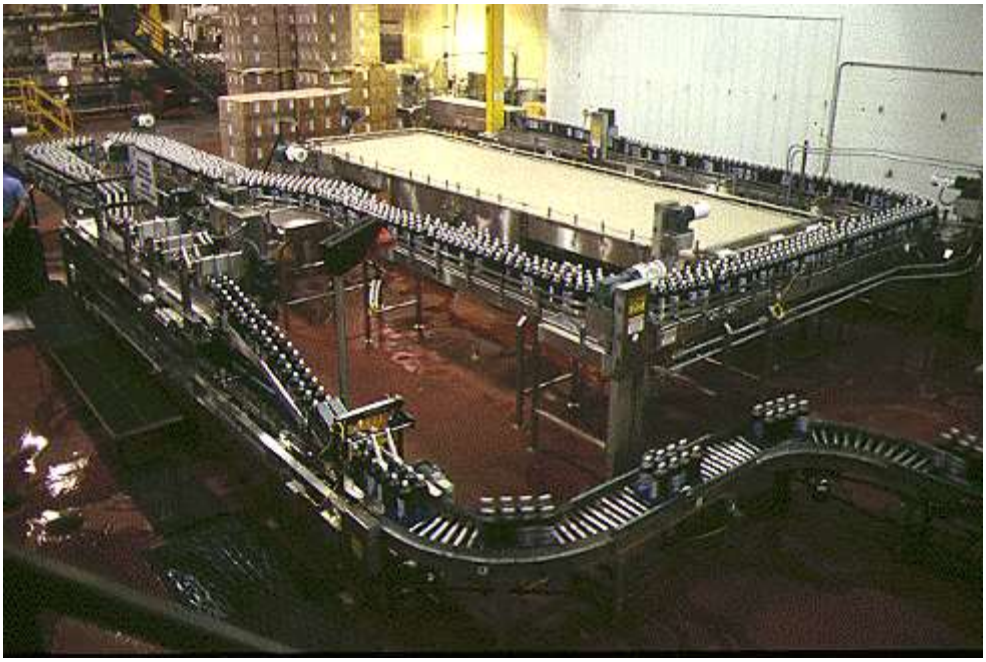

Figure 1: Eight-packs of 2-litre soft drink plastic bottles on the way to an automatic palletizer

The filling and packaging room usually is separated from the rest of the facility, protecting open product from any possible contaminants. The highly automated filling operation requires a minimal number of personnel (Figure 1). Filling room operators monitor the equipment for efficiency, adding bulk lids or caps to the capping operation as necessary. Empty bottles and cans are transported automatically to the filling machine via bulk material-handling equipment.

The packaging and labeling of this learning focus on alcoholic and some of non-alcoholic beverage.

1.1 Soft Drink Concentrate Manufacturing

Soft drinks make up for a large part of the non-alcoholic drinks category. In most established markets around the world, soft drinks now rank first among manufactured beverages, surpassing even milk and coffee in terms of per capita consumption. Including ready-to-drink, packaged products and bulk mixes for fountain dispensing, soft drinks are available in almost every conceivable size and flavour and in virtually every channel of retail distribution. Complementing this universal availability, much of the soft drink category's growth can be attributed to convenient packaging. As consumers have become increasingly mobile, they have chosen for easier-to-carry packaged goods. With the advent of the aluminum can and, more recently, the resalable plastic bottle, soft drink packaging has become lighter and more portable.

Stringent quality-control standards and state-of-the-art water treatment processes also have afforded the soft drink industry a high degree of confidence regarding product purity. Moreover, the manufacturing or bottling plants that produce soft drinks have evolved into highly mechanized, efficient and spotlessly clean food-processing facilities.

Figure 2: Soft drink canning line showing filling operations

As early as the 1960s, most bottlers were producing beverages through machinery that ran at 150 bottles per minute. As product demand has continued to skyrocket, soft drink manufacturers have shifted to faster machinery. The advance technology in production, filling lines now are able to run in excess of 1,200 containers per minute, with minimal downtime except for product or flavour changes. This highly automated environment has allowed soft drink manufacturers to reduce the number of employees required to operate the lines (Figure 2). Still, as production efficiencies have risen dramatically, plant safety has remained an ever important consideration.

Figure 3: Filling and packaging of Soft drink

Figure 4: Filling and bottling carbonated soft drinks

Steps of soft drink filling and packaging

- The finished product (the carbonated beverage) is transferred into bottles or cans at extremely high flow rates. The containers are immediately sealed with pressure-resistant closures, either tinplate or a steel crown with corrugated edges; twist offs, or pulls tabs.
- Because soft drinks are generally cooled during the manufacturing process, they must be brought to room temperature before labeling to prevent condensation from ruining the labels. This is usually achieved by spraying the containers with warm water and drying them.
- Labels are then affixed to bottles to provide information about the brand, ingredients, shelf life, and safe use of the product. Most labels are made of paper though some are made of a plastic film. Cans are generally pre-printed with product information before the filling stage.
- Finally, containers are packed into cartons or trays which are then shipped in larger pallets or crates to distributors.

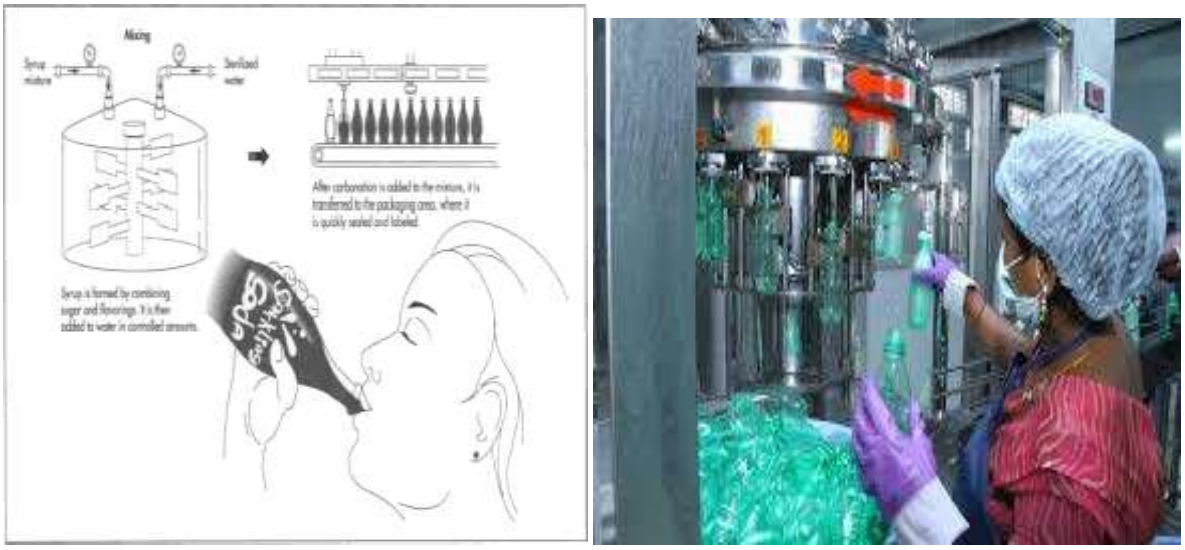

Figure 5: Transferring the carbonated beverage in to bottling

Nowadays, soft drink packaging uses different technologies. The most common packages are those produced from hot and cold technologies.

1) Hot filling

This technique is practically limited to glass packaging only. This is one of the oldest technologies. The beverage is introduced into the bottle at 85°C then covered. Pasteurization and cooling of the tunnels follows until it becomes stabilized. This technology has a long phase of pasteurization of the products, which leads to some organoleptic changes and vitamin losses.

2) Cold Filling

There are three cold filling technologies:

1. Iso-barometric Fillers: Applied to soft drinks, when the packaging, made of PET or glass, is filled by an iso-barometric system, capped and pasteurized in the tunnel. The filling is done at 3ºC or 4ºC, the tunnels are also much longer.
2. Ultra-clean system: applied to low temperature filling beverages, and where environmental conditions are very strict. This type of product normally has a short shelf life of about 30 days and is distributed under chilled conditions. These products are of high quality, "pasteurized flash" and applied for carton and PET packaging.
3. Sterile filling: The sterile filling retains the best product according to its nutritional qualities, organoleptic and its shelf life.

With this technology, the different filling systems gets the packaging sterilized first before filling it, in an environment that is also sterile. Sterilization of the packaging, with peroxide or acetic acid, must then be dried to remove any traces. The sterility of the filling atmosphere is achieved by filtering the air and sterilizing at high temperature.

1.2 Alcoholic Beverages

Alcoholic beverages are divided into two groups, depending on their mode of preparation: fermented beverages, such as wine and beer, and distilled beverages, such as whisky and brandy. Liqueurs are basically prepared by blending juices or extracts of fruits, nuts or other food products. The phases of activity in distilled spirits

production include receiving of grain, milling, cooking, fermentation, distillation, storage, blending and bottling.

1) **Fermented Beverages**

Wine Bottling

Wine is usually sold in glass bottles (of 1.0, 0.8, 0.75 or 0.30 liter capacity); glass containers of 5liter are occasionally used. Plastic containers are not as common. In the filling plants, bottles are first cleaned and then filled, sealed and labelled. Conveyors are widely used in bottling plants.

Figure 6: Wine Bottling Machine (Operation of Washing, filling and Bottling)

Figure 7: Labelling wine using simple machine

Depending on the size of industry the packaging and labelling operation is performed in the automatic wine bottling machine (figure 6) or simple machine (figure 7). At this time the conveyor is used to link that runs through the entire bottling line, so it is required.

After washing the bottles, they are sent to the dryer by the conveyor to disinfect and dry the bottle, and then the bottle is transferred to the filling machine. The bottle is positioned and filled, and then transferred to the capping machine to seal the bottle. The final step is labeling and coding. This is the entire filling process.

Beer Packaging/Bottling

Packaging is not just packaging. It plays an important role in attracting consumers and raising your business. Packaging is the most important process in the beer production which contributes up to two-thirds of the cost of the whole process. While packaging, beer should be prevented from contamination from stray yeast and exposure to oxygen as it reduces the shelf life. Many startups to medium sized brewers used the manual filling for beer packing, while automated packaging lines are also used in large breweries.

Figure 8: Beer Bottles on the Conveyor

Beer can be packed in bottles, cans or kegs; each has its own pros & cons. Bottled or canned beer have more than 80% of the market and affords the largest access to customers. Beer in bottles is more popular but this method has some disadvantages also. It includes the weight of the glass, its cost in addition to difficulty in transportation.

Glass bottles are very common in beer packaging. It is a natural, hygienic and traditional material used for making beer bottles. In bottling following steps are involved:

1) **Depalletising:** In this, empty bottles are removed from pallets.
2) **Bottle washing:** Bottles are rinsed with filtered water to remove impurities and cleared of labels. Sometimes carbon dioxide injected into bottles to reduce oxygen level. Empty Bottle Inspector (EBC) used to check the bottles for good washing otherwise rejects it.
3) **Filling & capping:** washed bottles are then sent to filling machine which fills the bottles with beer. A few inert gases can be injected on the top to disperse the oxygen. Full Bottle Inspector (FBI) check bottles for under filling or overfilling. Capper applies bottle caps and sealed the bottles.
4) **Pasteurization**: Filled bottles are then pasteurized at 140^0F for 2-3 minutes. This helps to stops the growth of yeast that remains in the beer after packaging.

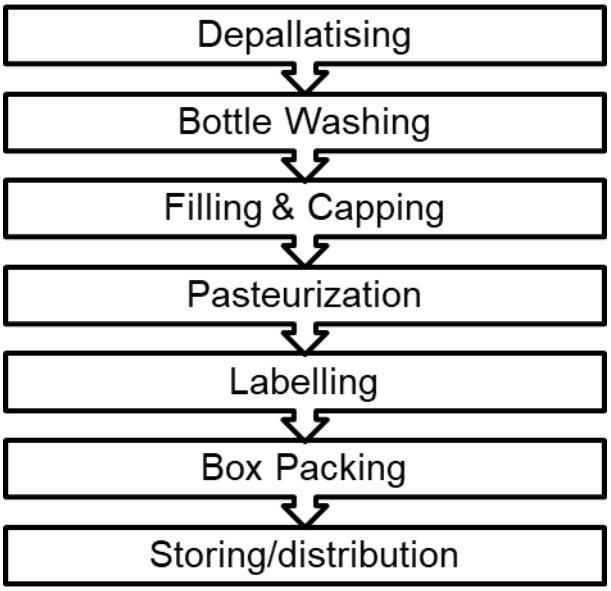

Figure 9: Flow diagram of the brewing process

5) **Labeling**: After pasteurization labels are applied. It should include the batch number, lot number, date & time of bottling, expiry dates etc.
6) **Box packing**: Bottles are then packed into boxes and sent to the warehouse and ready for sale.

The step of Depallatising is the process of preparing bottles for washing. So, the bottle washing process is discussed under Learning Guide “Operating a Bottle washing Machine”.

Kegging Of Beer

Packaging beer in keg is called kegging. It requires sanitizing, filling, capping one keg only instead of dozens of bottles, therefore, it is faster than bottling and canning. It is cheaper also. A keg is made of stainless steel and its top & bottom are usually made of rubber. Keg must have opened at the top (figure10).

Canning of Beer

Cans are innovative, smart, easy to use option and less expensive than glass bottles. Generally, aluminum cans are used. Cans are first washed with pure water and then carbon dioxide is injected into empty cans. Then they are filled with beer. After filling, lids are placed on the top and it moved to seamer. After seaming, cans are moved to exterior rinsing and packed in the pack of six for sale. Cans are less resistant to strikes and dents. They require less space and easy for transportation also.

Figure 10: Keg for beer packaging

Figure 11: Canned Beer

2) Distilled Spirits Industry

Distilled spirits can be produced from any number of materials, such as fermented mashes of cereal grains, fermented fruit juices, sugar cane juice, molasses, honey and cactus juice. Fermentation for making wine and beer can be traced back to between 5000 and 6000 BC; however, the history of distillation is much more recent. Although it is uncertain where distillation originated, it was known to alchemists and began to spread in use throughout the thirteenth and fourteenth century. Early uses were primarily pharmaceutical.

Once the wine products have been matured, they are blended and filtered and then packaged as finished products for consumer use. The bottling room is separated from the rest of the facility, protecting the product from any possible contaminants. The highly automated filling operation requires monitoring for continuous efficiency. Empty bottles are transported by conveyor to the filling machines. Packaging is the final step prior to warehousing. This process has become automated, although there is a fair amount of manual packing, depending on size of bottle and type of packaging. The packaged product then enters a palletizing machine, which automatically stacks boxes on pallets, which are then removed by fork-lift trucks to warehouses for storage.

Figure 12: Packaging and Labelling of distilled spirit (Whiskey)

1.3 Labelling requirements

Labelling Requirements of Soft Drinks

Nutrition Labeling: the Nutrition Facts Panel on carbonated soft drinks typically includes the serving size and the nutrients provided in a serving: calories, total fat, sodium, total carbohydrate, sugars (if present), and protein. If a nutrient content claim, such as “Very Low Sodium,” appears on the label, the manufacturer must also add the statement “Not a significant source of _____,” with the blank filled in by the names of nutrients that are present only at insignificant levels.

Additional Label Information: additional information on carbonated soft drinks containers includes:

- Name and address of the manufacturer, packer or distributor.
- The net quantity or the amount of carbonated soft drink in the container.
- All the ingredients, listed in order of predominance by weight. In other words, the ingredient that weighs the most is listed first, and the ingredient that weighs the least is last. For carbonated soft drinks, the first ingredient usually will be carbonated water.
- Chemical preservatives with an explanation of their function, such as: “preservative,” “to retard spoilage,” “a mold inhibitor,” “to help protect flavor,” “to preserve freshness,” or “to promote color retention.”

Diet carbonated soft drinks containing phenylalanine must also include the statement, “PHENYLKETONURICS: CONTAINS PHENYLALANINE,” for individuals who suffer from phenylketonuria, a genetic disorder in which the body can’t process that amino acid. If the phenylalanine level gets too high in these individuals, it can damage the brain.

Labelling requirements for alcoholic beverages

These requirements apply to beverages such as beer, wine and spirits. The labelling requirements may not be applicable where the alcoholic beverage is sold in such a way

as to be exempt from these requirements. However, in these situations, information may need to be displayed or provided to the purchaser.

- The label on the package of an alcoholic beverage containing 1.15% alcohol by volume or less must also include a statement of the alcohol content. This does not apply to alcoholic beverages containing less than 0.5% alcohol by volume. The statement must indicate that the alcoholic beverage contains not more than a certain proportion of alcohol by volume, with the food business to include the proportion in the statement. The specific wording for the statement is not prescribed, although a specific statement is provided in the Code for indicative purposes i.e. 'CONTAINS NOT MORE THAN X% ALCOHOL BY VOLUME'.
- **Labelling and Other Information Requirements**
  - ✓ Food Identification Requirements
  - ✓ Mandatory Warning and Advisory Statements and Declarations (where relevant)
  - ✓ Date Marking of Food
  - ✓ Directions for Use and Storage (where relevant)
  - ✓ Nutrition, Health and Related Claims
  - ✓ Nutrition Information Requirements (where a nutrition content claim is made)
  - ✓ Legibility Requirements
  - ✓ Country of Origin Requirements

Self-check 1	Written test

Name…… ID……. Date…….

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

Test I: Short Answer Questions

1. What type of materials appropriate for packaging alcoholic beverage? Why? (5 points)
2. What type of materials appropriate for packaging non-alcoholic beverage? Why? (5 points)
3. What are the labelling requirements for soft drink? (5 points)
4. What are the labelling requirements for alcoholic beverage? (5 points)

Note: **Satisfactory rating - 20 points** **Unsatisfactory - below 20 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

   _____

2. _____

   _____

3. _____

   _____

4. _____

   _____

Information Sheet 2- Monitoring equipment operating variation

Equipments should be monitored on operation because they may result in operation variation against the standard. This variation may cause machine and equipment fail, unfit product quality and hazards on worker. The most risk related to this is risks of bottling.

2.1 Equipment Variation

Every company, no matter which industry it belongs to, relies on the health of its equipment in one way or the other. The downtime or unavailability of equipment leads to time wastage and potentially lost sales. This is why taking good care of the equipment you own should be a top priority. However, it can be quite a struggle to ensure that all these important assets are maintained and inspected as often as needed. It is crucial to maintain an equipment maintenance log for many reasons. For starters, it helps ensure that the revenue-generating operations are constantly progressing as required without any disruptions in the form of unexpected downtime.

Container sample testing is one of checking the quality of container to be used. Container and closure samples should be pulled from the production line (just before filling) and tested quarterly to be sure they are free of bacterial contamination. Four samples of each type of bottle and each type of cap used should be tested quarterly. The figure below show the critical control points on beverage bottling industry.

2.2 The risks of bottling

The risks of bottling arise from the handling of glass material; these vary according to whether the bottles to be washed are new or returned, and according to the products used (water and detergents) and the techniques applied (washing by hand or mechanically or both). Bottles' shape; how the filling must be done (ranging from manual methods to sophisticated filling machines which can also introduce carbon dioxide); the process of corking; the more or less complicated system of stacking, or placing into boxes or crates after labelling; and other final touches determine the risks.

The risks involved are those which generally correspond to the filling of containers with liquids. The hands are constantly wet; if the bottles break, the projection of glass particles and liquid can cause injuries. The effort required to transport them once they are packed in boxes (usually by dozens) could be eliminated at least partially by mechanization.

Self-Check – 2	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions

1. Discuss equipment variation (2 point)
2. Discuss risks of bottling (4 points)

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

_____

2. _____

_____

Information Sheet 3- Reporting equipment maintenance requirement

The failure on equipment should require reporting for maintenance to the appropriate personnel. The defect or failure on equipment and the maintenance of the equipments should be clearly stated. To report the requirement should be identify the hazards or risk on the equipment /machine. The appropriate formats should be used to record and report the maintenance requirements. Most industries used standard format called equipment maintenance log.

Equipment Maintenance Log

The equipment maintenance log is a simple document that contains a list of all actions that have been performed on a certain piece of equipment. It helps keep track of the maintenance history. It generally contains the following two different sections, each containing different types of information:

1. **General information**

The first section has to do with general information. This information is used to identify the piece of equipment. It most commonly includes

- Name of equipment
- Model or manufacturer
- Serial number
- Location and person responsible for equipment.

Some equipment maintenance logs also include the Purchase date and Purchase price in this section.

2. **List of maintenance actions**

The second section lists all the maintenance actions performed on the equipment. It commonly includes the following fields:

- Date when the action was performed
- Description of the action itself

- Name of the person performing the actions

Lastly, some logs also include a Remarks section. This section is useful in case the person performing the maintenance might have any special notes to add for future reference.

Table 1: Equipment maintenance log

What does an Equipment Maintenance Log include?			
Name of equipment		Location	
Serial number		Manufacturer/Model	
Purchase date		Person responsible for equipment	
Date in service	**Description of maintenance**	**Maintenance performed by**	**Additional Notes**

Important of equipment maintenance log

1. It increases resale value of equipment

Proper maintenance and tracking of the equipment maintenance log help your equipment to run in optimal condition. Record keeping also proves to be useful when you decide to replace your current equipment with newer versions.

2. It saves the upfront costs

Having a complete equipment maintenance log lets you know when the time is right to replace equipment. This, in turn, helps you save money. The data that is gathered over time unveils patterns of failure, expenditure, and repair.

3. It identifies trends across makes, models, or components

The equipment maintenance log throws light on the common trends in your equipment across models, components, makes, operators and more. The data on equipment

maintenance log tracked by a maintenance management solution highlights which models and makes of certain equipment incur the lowest cost per hour of ownership.

4. It increases the safety of operators

All sorts of machinery that you use is prone to wear and tear. Routine inspections let you see into repair issues and small damages before they turn into bigger problems. Even documenting these small repairs and inspections goes a long way in tracking all maintenance tasks that your equipment goes through.

Self-Check – 3	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions

1. Discuss equipment maintenance log (2 points)
2. What type of information to be record in equipment maintenance log? (4 points)
3. Discuss the importance of equipment maintenance log? (4 points)

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

_____

2. _____

_____

3. _____

_____

_____

_____

Information Sheet 4- Monitoring packaging process

The packaging process of food and beverage require a consistence monitoring. Because, it is a critical control point which cause a contamination of product. Filling & capping and Pasteurization are processes that need monitoring throughout the processing. The monitoring processing carried out by manual inspection or automatic technology combined with computer software.

New solutions for digital food production, including control station applications, industrial image processing, and ERP software. It allows companies to improve resource efficiency, increase transparency and reduce costs.

Figure 13: industrial image processing, and ERP software.

Bottling Inspection

With regards to this, we offer the neck finish inspection, which combined with the inspection of the bottom, makes it possible to identify these defects and guarantees a thorough quality check of the areas of the bottle that may cause food safety issues. Then there are all the other less particular, but still important inspections, such as checking for dirt and foreign bodies on the outside. Aluminium is also starting to be used

in certain foreign markets and as a result, wine is packaged in cans. In this case, there are no issues related to cracks, but in any case, the can may contain foreign bodies and/ or be warped in the area of the flange or the body, thereby causing unexpected production stops in the filling block, thus reducing line efficiency. The bottle neck is a very delicate part that can easily be subject to cracking or chipping. In the phase prior to filling, it is important to check for such defects, not only as an aesthetic factor, but also for food safety.

Fill level monitoring

Fill level monitoring is a leap forward in the science of assuring the appropriate amount of product goes into any given container during factory production. It provides a key element in the safe production of food, beverages and pharmaceuticals in the United States, as well as in Europe and Asia. Superior to the other methods that had previously dominated the industry, fill level monitoring can guarantee 100% accuracy in monitoring and inspecting beverage and food packaging.

About Fill Level Inspection

The goal of fill level inspection is to ensure that any metal cans, glass bottles, plastic bottles or composite containers are filled to exactly the correct height. The system also ensures accuracy in the labeled contents in beverage containers, as well as verifying the appropriate headspace in cans of food for heat treatment. The technology calculates the average fill levels for evaluation of filler performance, inspects the minimum-solids levels and checks over/under levels in all liquid products.

Monitoring CO_2 accumulation

Carbon dioxide (CO_2) is added to soft drinks during the bottling process to give the drink its fizz. While the soft drink containers are being filled during the bottling process, large volumes of CO_2 are emitted from the fillers into the filler room atmosphere. If the filling rooms and the work areas are not adequately ventilated, CO_2 can accumulate in the indoor air. CO_2 is a colorless, odorless, tasteless gas that poses a potential risk to human health in high concentrations. CO_2 level should be monitored to avoid CO_2 accumulation.

Figure 14: Monitoring CO_2 accumulation

Self-Check – 4	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions

1. How monitor packaging process? (2 points)
2. Discuss monitoring fill level (2 points)
3. Discuss bottling inspection (2 points)

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

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2. _____

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3. _____

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Information Sheet 5- Identifying out of specification process outcomes

Packaging equipment, such as cap and label applicators and date coder operation efficiency, should be inspected regularly for correct application, legibility and accuracy. Contents of the filled product bottles should be verified regularly based on volume or weight. The figure below shown that the critical control points of filling and bottling processing.

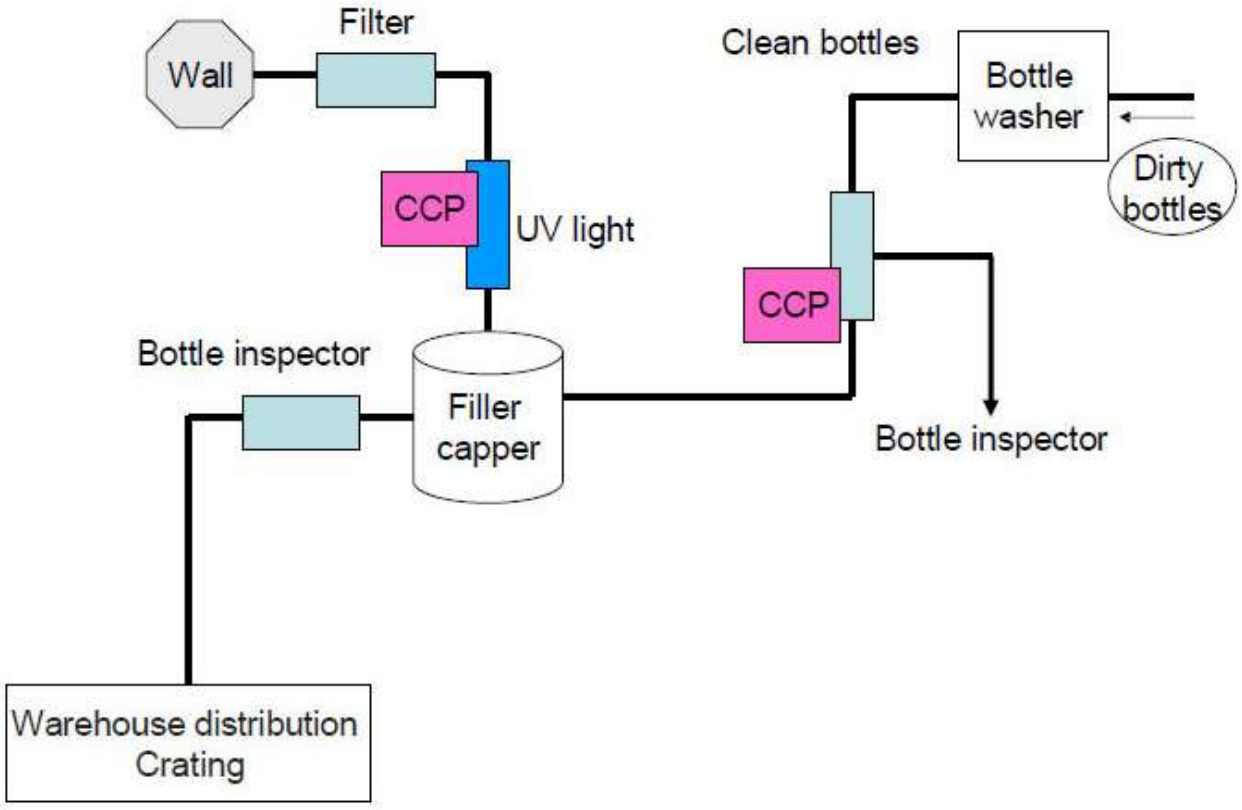

Figure 15: Figure Critical control points (CCPs) in the water bottling process

Standards of Bottling and Labeling of beverage

Bottle Pasteurization (CCP11)

Pasteurization is carried out to ensure the beer shelf life over a period of months. This is accomplished by the development of tunnel pasteurization in which the beer bottle is subjected to 60^0C for 20 min. Over-pasteurization, which causes oxidation and can adversely affect beer flavor is a potential physical hazard. Furthermore, it is crucial to

check the time-temperature procedure with adequatecorrective actions for assuring the production of a satisfactory product

Bottle Inspection (CCP12)

Bottle inspection after the pasteurization step is important to ensure that bottles have not been damaged during the process. Should such a situation occur, the equipment has to be standardized by the production engineer.

Labeling and Standardization (CCP13)

Labeling of the package should comply with the requirements of the Codex General for the labeling of prepackaged foods. This means that the name of the product shall be clearly declared, there must be a list of ingredients in descending order of proportion, no other fruit may be represented pictorially except those used, and “the date of minimum durability” will be declared by the month and year in encoded numerical sequence.

Bottle/Can Packaging (CCP14)

Bottles (cans) are packaged into paperboard boxes of various sizes, according to the bottle or can dimensions. The encountered hazards can be of physical nature concerning the bottles (cans) condition during the procedure

Possible risks from stages of wine packaging and labelling

Table 2: Possible Risks

Stage of Packaging and Labeling	Possible risks
Wine ready for bottling:	• Residues of agricultural chemicals, sulfur dioxide, additives such as preservatives, allergens from fining agents such as some animal proteins and derivatives
Bottle Storage	• Contamination by foreign objects, matter, insects, sabotage
Depalletising	• Bottle breakage and glass fragments • Contamination by foreign objects, material

Rinsing	• Glass fragments • Contamination by foreign objects, matter
Bottle Filling	• Glass fragments due to breakage • Microbiological contamination due to inefficient sanitization
Corking/capping	• Glass fragments due to breakage • Contamination by foreign objects
Labelling	• Labelling Sulfite declaration • Allergen declaration Health advisories: alcohol content, pregnancy, pressure and opening

Addressing the main risks in bottling

The monitoring the operation condition of equipment should be performs before operation, during operation and after operation. This is important to take a corrective action which used to address the main risk in bottling. Here are activities to be done to address the main risks arising from bottling.

1) Pre Bottling

- Pre and post bottling samples are checked before release
- Require approved grape spray programs
- Use only new bottles, securely stored undercover

2) Rinsing

- Use certified glass containers
- Correct set up and operation of the depalletiser
- Preventive maintenance of the rinser
- Adequate water pressure to the rinser
- Visual checks and random inspections of the entire line
- Minimize and cover the bottling line from rinser to closure machinery.

3) Filling

- Follow protocols for bottling line clean up after any breakage

- Establish and follow bottling line sterilization protocols, including filter integrity testing, prior to start up, during operation and between stoppages

4) Closing

- Buy closures from certified sources in sealed packages
- Open only as needed Cover closure hopper in closure machine
- Only use complete closure packages
- Minimize and cover packaging line conveyor between filling and closing machines
- Operator training Setup control and checklist

Self-Check – 5	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions

1. Mention the critical control points on beverage bottling and labelling (2 points)
2. What are the standards for each critical control points? (5 points)
3. Discus possible risks from stages of wine packaging and labelling (5 points)
4. What are activities done to address the main risks arising from bottling (5 points)

Note: **Satisfactory rating - 17 points** **Unsatisfactory - below 17 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

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2. _____

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3. _____

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4. _____

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Information Sheet 6- Maintaining housekeeping standards

Workplace housekeeping standard applied for conducting sampling procedure of bee product processing is consider standards of cleaning in the food and beverage processing industry. For sophisticated and safety-conscious food factories, using traditional tools such as rags, scrubbing brushes and hoses are no longer an ideal fit. The following are best practice cleaning methods to follow for the food and beverage processing industry.

1. Wet vs dry cleaning

Traditional cleaning methods include hosing down chemical, scraps, oils and grease. The main flaw with this method is that it doesn't agitate the surface, which is fundamental to getting deep within the surface, including any pores and crevices. A process that combines a 4-in-1 approach of washing, scrubbing, steaming and drying food processing equipment and surfaces is ideal. These steps allow for not only sterilization (if steam temperature is high enough) but a mechanical agitation, which allows for the removal of food scraps, dirt and grime.

When looking at a steam cleaning processes, it's important that 'dry' steam is used. The dry component significantly reduces the risk of residue build-up or the occurrence of moist/wet floors, which can lead to slips and falls. Another critical factor when it comes to wet vs dry cleaning is that some processing equipment shouldn't get wet. Wet equipment can lead to machinery faults and rust.

2) Automated and interval cleaning

Traditionally, cleaning could only be done either before production or after, and if it occurred during production hours, machines would need to be turned off for the cleaning to occur.

Inline cleaning systems are modern methods that allow for food and beverage processing equipment to be steamed, vacuumed and removed of any waste in one process, without the need to stop and swap equipment or tools. This greatly reduces the risk of contamination further down the production line. Surfaces receive a deep clean while production is occurring rather than a wipe down at the end. It also reduces resources, labor and downtime.

Validation of cleaning processes

An increase in regular ATP testing is becoming a standard in many food and beverage processing factories. ATP testing allows for microorganisms to be detected and subsequently prevent contamination. Using invisible or fluorescent lights is becoming a popular auditing tool in industries where contamination prevention or infection is paramount. Some microorganisms can be detected under fluorescent light.

A cleaning audit can also be taken one step further when using florescent tools. Areas to be cleaned in a factory can be marked with an 'invisible marker'. Once cleaning has occurred, a fluorescent torch can be used to see if the invisible markers are still present. If invisible marks are still present, then the surface has not been adequately cleaned.

Stricter infection control procedures

Implementing procedures to 'safeguard' a food and beverage processing environment is almost becoming just as important as the cleaning itself. An example of a safeguarding process can be seen in the use of ultraviolet (UV) light methods. UV light continues to protect and sterilise an environment post cleaning. If a surface is contaminated during production hours, this leaves 12 hours or more for microbes to grow while the factory is closed for the day or in non-production hours. UV light will reduce the risk of this contamination from occurring by acting as a 'night watch' for bacteria during production downtime.

Self-Check –6	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions

1. What the standard housekeeping for bee product processing? (2 points)
2. Discuss the two best practice cleaning methods to follow for the food and beverage processing industry (4 points)
3. Discuss validation of cleaning processes (2 points)
4. Discuss the stricter infection control procedures (2 points)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

   _____

2. _____

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3. _____

   _____

4. _____

   _____

Information Sheet 7- Applying work environmental guidelines

7.1. Health and Environmental Concerns

Beverages, both alcoholic and non-alcoholic, are normally produced under strict sanitary guidelines set by governmental regulations. To meet these guidelines, equipment within beverage plants is constantly cleaned and disinfected with harsh cleaning agents. The copious use of cleaning agents can, in itself, pose health problems to the workers exposed to them in their job duties. Skin and eye contact with the caustic cleansers can cause severe dermatitis. Another concern is that inhalation of the fumes or spray produced when using the cleansers may cause damage to the lungs, nose, mouth or throat. Water or other liquids are commonly found in and around production, making slips and falls a common injury and causing many other injuries simply due to poor traction.

Environmental concerns are not often associated with beverage production, since it is not thought of as a “smokestack industry”. Excluding an accidental release of a hazardous chemical such as anhydrous ammonia or chlorine, the main discharge from beverage production is wastewater. Usually this wastewater is treated prior to entry into the waste stream, so it is rare that a problem occurs. Occasionally a bad batch of product has to be discarded, which, depending on the ingredients involved, may have to be transported away for treatment or greatly diluted before release into the waste system. A large quantity of acidic beverage finding its way into a stream or lake can cause large fish kills and must be avoided.

The increasing use of chemical additives for enhancing flavour, extending shelf life or as a substitute sweetener has raised public health concerns. Some chemicals used as artificial sweeteners are prohibited in some countries because they have been found to be carcinogenic. Most, however, present no apparent health risk to the public. The handling of these raw chemicals and their presence in the workplace has not been studied in enough depth to determine if there are worker exposure risks.

Wastes from the propagation process is collecting, disposing and recycling /treating/ according to alcoholic beverage guideline and the industry capacity. Recycling after treating is the main management in yeast propagation processes in beverage industry. In mead or brewing yeasts carry a persistent low level of contaminants such as *Obesumbacterium proteus*, acetic acid bacteria, and slow-growing Torula-type yeasts. These organisms are generally regarded as harmless because their numbers never reach a point where they are likely to have adverse effects on the beer. On the other hand, *L. pastorianus, Z. anaerobia, and S. carlsbergens is* strains considered harmful at low levels.

7.2. Waste management

The SOPs had to incorporate the modernized GMPs is similar. Environment consideration is the main and mandatory in food and beverage processing. As we discussed under waste management and hazard control, work should be conduct based on the environment guidelines to avoid workplace hazards it may be biological, physical or chemical.

Removal of waste from the facility is required to maintain an environment that does not offer the potential of adulteration.

- Payment of accounts must be kept current to maintain this utility.
- Personnel throughout the facility will, per department supervision, be responsible for placing non-recyclable waste in appropriate recepticles. Those recepticles will be moved in timely manner to collection points.
- A timely pick up schedule will be determined with the third party supplier of this utility.
- Audits of the plant for waste and sources of waste will be performed regularly
- These actions must be documented.

7.2. Waste Disposal

Waste from the food and beverage industry may be disposed or treat or recycle after collection. Disposal waste from food and beverage industry measured by the following parameters:-

- Are the non-edible by-products and other refuse removed as quickly as possible from rooms where food is present so as to avoid their accumulation?
- Are the non-edible by-products and other refuse deposited in closable containers or any other appropriate foot operable container to prevent contamination?
- Are the containers made of an appropriate construction, kept in sound condition, easy to clean and, where necessary, to disinfect?
- Is there adequate provision made for the storage and disposal of waste, non-edible by-products and other refuse?
- Are the refuse stores are designed and managed in such a way as to enable them to keep clean and, where necessary, free of animals and pests?
- Is all waste eliminated in a hygienic and environmentally friendly way in accordance with state pollution control board's consent and does not constitute a direct or indirect source of contamination?

Self-Check – 7	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions

1. What type of contaminants which carry a persistent low level in mead or brewing yeasts (3 points)
2. Mention strains considered harmful at low levels (3 points)
3. Discuss at least two of parameters measured among disposal waste from food and beverage industry (4 points)

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

_____

2. _____

_____

3. _____

_____

Information Sheet 8- Maintaining work place records

Workplace information is recording throughout the process in food and beverage industry. This work may protect from any mistake of product selection and its amount, the procedure of the process, the monitor of the required parameter of the product, etc. If any defect is happen from the process, we can cross check with the record and can take the appropriate correction action.

Recording workplace information include:

- Standard Operating Procedures (SOPs)
- specifications
- production schedules and instructions
- routine maintenance schedules
- work notes
- Material Safety Data Sheets (MSDS)
- manufacturer instructions
- Verbal direction from manager, supervisor or senior operator

Record keeping is essential, especially to comply with food safety and quality requirements. The formats should develop for keeping records. The food safety plan of the enterprises will specify what records need to keep.

The following are some records in prepare and monitor yeast cultures with respect to yeast propagation production processes might keep:

- cleaning and sanitizing schedule for the extracting room
- cleaning and sanitizing schedule for each piece of equipment
- register of date/time of checks of containers for cleanliness and condition
- approved Suppliers list
- batch numbers
- number of supers and their identification numbers
- number of containers filled for each type of yeast culture and propagated yeast

- samples collected, including identification numbers to link them to batches of products and suppliers or the required test of yeast culture and propagated yeast at storage
- temperature, pH, sugar content and other parameters' test during the process
- Encountered problems in quality and safety
- Take measurements

•

Self-Check – 8	Written test

Name…… ID……. Date…….

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

Test I: Short Answer Questions

1. Mention workplace information need to be record? (8 points)
2. What are records to be keep during monitor with respect to yeast propagation production processes might keep? (at least 5 of them) (5 points)

Note: **Satisfactory rating - 13 points** **Unsatisfactory - below 13 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

   _____

2. _____

   _____

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

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

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

Learning Instructions:

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

Information Sheet 1 identifying shutting down procedure

1.1 Introduction

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

1.2 The types of shutdowns

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

1.2.1 Scheduled shutdown

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

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

The shutdown procedure will depend on the type of equipment and the process chemistry.

Some steps taken in a unit shutdown may include:

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

1.2.2 Maintenance shutdown

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

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

A planned unit shutdown will prevent:

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

To prepare the unit for shutdown, the unit may need to be:

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

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

1.2.3 Emergency shutdown

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

1.2.4 Trips

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

Typical shutdowns initiated by trips may include:

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

1.2.5 Shutting down to a standby condition

When a unit is to be shut down for a short period of time for maintenance on auxiliary equipment, the unit is shut down to a standby condition.

A standby shutdown allows a quick startup of the unit after maintenance is completed in order to minimize lost production time and offspec material.

Standard Operating Procedures must be referred to when shutting down each type of unit to a standby condition.

A typical standby condition may include:

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

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

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

Note: **Satisfactory rating – 17 points** **Unsatisfactory - below 17 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1. _____
2. _____
3. _____
4. _____

Information Sheet 2 Shutting down the Process

2.1 Introduction

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

Steps to follow for proper shutdown of manufacturing line

End of production sequence

When pausing a manufacturing line, it is crucial to allow the machine to empty itself of all the components. The end of the production sequence clears the manufacturing equipment without loading new products into the cycle. This cycle finishes components in a machine and automatically removes most of the glue, parts, liquid, and powder from the production path. There are, however, certain elements that will not be automatically emptied until a later stage of the manufacturing processes. It may be necessary to remove these elements manually and thus completely empty the machine of any stray material that can complicate startup. This first step is crucial. For instance, we had experience with a temporary equipment shutdown where oil was left inside certain containers. This oil froze and hardened during the production disruption. When we wanted to restart the line, the oil had become like a resin, gumming up the machine and requiring cleaning that was more labor-intensive and time-consuming than if it was completed at the time of the shutdown.

- **Air purge**

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

- **Cleaningof the machine**

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

- **Preventive maintenance**

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

- **Environmental**

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

- **Protection**

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

- **Electricity**

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

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

- **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. Many factors are out of your hands, such as the duration of a shutdown period. It is key to focus on what you actually can control. The approach to maintaining your machine, assembly lines, and manufacturing premises, is something you have the ability to actively manage.

Self-Check – 2	Written test

Name…… ID……. Date…….

Directions: Answer all the questions listed below. Use the Answer sheet provided

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

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1

- _____
- _____
- _____
- _____

2

- _____

3_____

- _____
- _____
- _____

Information Sheet 3- Identifying and reporting maintenance requirements

3.1 Introduction

Maintenance can be defined as working on something to keep it in a functioning and safe state and preserving it from failure or decline.

Maintenance procedures are written instructions that, when followed by the maintenance personnel, will ensure that equipment operates as designed within safe operating limits.

Maintenance may include:

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

3.2 Types of maintenance

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

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

3.3 Routine maintenance tasks

Routine maintenance tasks refer to:

On-going scheduled tasks that are performed in order to keep hand tools and basic equipment functioning properly.

It 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.
- Handles should be tight and free from defect.

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

Table.0.1 maintenance checklist

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

If necessary:

- Tighten nuts and bolts.
- Smooth off splinters and sharp points.
- Tighten shafts.
- Unblock pipes and nozzles.
- Sharpen blunt tools.
- Clean nozzles on sprayers.
- Check and maintain cables and plugs.

Scheduling routine maintenance

Reporting faults and problems:

Every work shop has a different maintenance schedule and it is important that you are familiar with the schedule implemented on the a work shop where you work.

There will usually be a routine schedule for particular tools that states how often maintenance checks have to be performed. These will also specify the checks that have to be performed. Some tools may require daily checks and maintenance after use.

Other tools, such as power tools, usually must be checked once in 6 months or so.

More complicated power tools would need to be serviced on a regular interval; refer to the operation manual.

A maintenance schedule assigns a specific date to specific maintenance tasks. It states what has to be checked and will require that the assigned person signs off the document assuring that the checks were done.

If faults are found, the tool must be sent for maintenance and the assigned person that fixes the tool has to report on exactly what was done and when it was completed.

An example of checklist is given below

Table.2 maintenance schedule

Date	**Tool**	**Maintenance check points**	**Signature**	**Maintenance required**	**Signature**

MaintenancePerformed	Date	**Signature**
Splinters shaved off		

Examples for how to fill or document maintenance required and report performed maintenance is given below:

Date	**Equipment**	**Maintenance check points**	**Signature**	**Maintenance required**	**Signature**

Maintenance Performed	Date	**Signature**

Splinters shaved off	20-10-2020	Mr. B

3.4 Perform safe maintenance

Do maintenance safely:

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

Self-Check – 3	Written test

Directions: Answer all the questions listed below. Use the Answer sheet provided.

1. List at list five points in some tips on routine maintenance. (4pts)
2. Define the two types of maintenance (4pts)
3. How do we/you perform maintenance safely?(8pts)
4. Define maintenance and write what maintenance may include. (4pts)

Note: **Satisfactory rating – 20 points** **Unsatisfactory - below 20 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1

- _____

2

- _____

3 _____

- _____

4. _____

- _____

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List of Reference Materials

1. Zaida Colon, Matthew Hirsheimer, R.G. Aldi and Rita Seguin, Beverage Industry, http://www.ilocis.org/en/contilo10.html.
2. Pratiksha Supekar, 2017, Beer Packaging Process With Flow Chart
3. Release Lime, 2019, Wine Bottling Process Flow Chart
4. Soft Drink- http://www.madehow.com/Volume-2/Soft-Drink.html#ixzz6cB586Ff3
5. Food Standards of Australia New Zealand, 2014, Labelling of Alcoholic Beverages User Guide.
6. **New Crown Machinery, 2018 , Soft Drink Filling Process and Operation**
7. APEC (Asia-Pacific Economic Cooperation), 2012, Risk Assessment and Management Labelling & Bottling Risk, Auckland, New Zealand.
8. L. K. Kourtis and I. S. Julian Andres,2001, Implementation of hazard analysis critical control point (haccp) system to the alcoholic beverages industry, Food Reviews International, 17(1), 1–44 (2001) ∗

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