# FRUIT AND VEGETABLE PROCESSING -Level-II

Based on May 2019, Version 2 Occupational standards

## Module Title: Operating a Packaging Process

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**Instruction sheet**

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

- Confirming packaging materials
- Identifying and confirming cleaning and maintenance requirements
- Fitting and adjusting machine components and related attachments
- Entering operation of equipment and processes parameters
- Loading material , product and packaging components
- Checking and adjusting equipment performance
- Carrying out pre start checks

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

- Confirm packaging materials
- Identify and confirm cleaning and maintenance requirements
- Fit and adjust machine components and related attachments
- operate equipment and processes parameters
- Load material , product and packaging components
- Check and adjusting equipment performance
- apply pre start checks

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. 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 packaging materials

### 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.

### 1.2 Materials Used in Food Packaging

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

Packaging materials include:

- Glass containers
- Plastic containers: can, Bottles Pet, plastic pouch
- Paper /carton box
- Metal can

### 1.2.1. Glass bottle package

Glass bottle is a package with long history. With more kinds of packages entering the market, it is less frequently used, but it remain as one of the most popular packages. Glass bottles have the following advantages:

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

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 1.1. Glass bottle

### 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 has 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.


Figure 1.2. Metal can package

### 1.2.3. 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 1.3. Paper package

| 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: Choose the best answer** (4 point)

1. One is not packaging material?

A. Paper B. glass C. metal D. none of the above

2. Which one of the following is the purpose of packaging?

A. Protect the product B. store the product C. carry nutritional information D. none

**Test II: Short Answer Questions**

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

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

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

## Information Sheet 2- Identifying and confirming cleaning and maintenance Requirements

### 2.1 Cleaning

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

### 2.2 Cleaning Methods

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

#### 2.2.1 Manual cleaning

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

#### 2.2.2 Foam cleaning

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

**Figure 1 foam cleaning**

### 2.2.3 Spray

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

### 2.2.4 Fogging

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

### 2.2.5 Machine washing

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

### 2.2.6 Cleaning in place (CIP)

Cleaning-in-place (CIP) is an automatically performed method of cleaning, applied to remove residues from complete items of plant equipment and pipeline circuits without dismantling or opening the equipment. It is a system of cleaning engineered to provide

fast, productive, consistent and reproducible high quality cleaning of all product contact surfaces to a predetermined level of cleanliness, by circulating chemical (detergent and disinfectant) solutions and rinsing water through tanks and piping of a 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.

## 2.3 Cleaning procedure

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

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

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

## 2.1 Legal cleaning requirements

Compliance regarding cleaning of food premises

Make sure that:

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

## 2.2 Maintenance requirements

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

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

**Do maintenance safely:**

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

| 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- Fitting and adjusting machine components and related attachments**

## 3.1 Machine Adjustment

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

## 3.2 Adjustment of Machine operation

### 3.2.1 Safety check

Check and make sure there is no foreign matter on:

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

### 3.2.2 Switch on the power

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

| Self-Check – 3 | Written test |
|---|---|

Name…… ID……. Date…….

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

**Test I: Short Answer Questions**

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

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

## Information Sheet 4 - Entering processing/operating parameters

### 4.1 Operation procedure of packaging equipment

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

This procedure aims to:

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

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

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

- Plant change.

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;
- The condition of ancillary process plant and equipment (clean, empty etc. as appropriate);
- Plant correctly set-up for processing;
- Process monitoring and recording;
- Monitoring and recording of key process parameters (temperature, pressure etc.) in plant logs;
- Quality;
- Sampling of raw materials, intermediates, products and effluent/waste;
- Packaging of final product.

| 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 aim of operational procedure during operating the machine or equipment**? (5pts)**
2. Comprehensive written operating procedures was generated which were applicable to address what? **(5pts)**

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

## Information Sheet 5- Loading material, product and packaging components

### 5.1 Loading

Moving product and packaging material from one place to the processing location using loading material such as conveyor. Different food and grades should be kept separate and loading to particular place to avoid for oxidative quality reasons. It is preferable to transfer different food 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 food in storage tanks, shore tanks, ship tanks and road and rail tanks; the food should be brought to transfer temperature by slow heating, so that the liquid is completely homogeneous. The temperature is chosen according to food type and also to minimize damage to the food.

Soft oils transfer temperature:

- Long term storage of all food should be at ambient temperature and no heating should be there.
- If the food 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. Readings should be taken not less than 30 cm away from the heating coils.
    - ✓ Different food grades/types should be kept separate.
    - ✓ Loading ‘new’ food into ‘old’ should be avoided for oxidative quality reasons.
    - ✓ The order of loading and discharge should be carefully chosen to minimize adulteration.

**Following principles should be considered during loading:**

- Right amount of material
- Right condition
- At the right place
- To the right position
- At the right time
- By the right method

| 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. Write loading techniques of food processing? (5 points)
2. Write principles of loading? (5 points)S

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

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

## Information Sheet 6 Checking and adjusting equipment performance

### 6.1 Checking equipment performance

**Evaluation of performance of packaging machinery**

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

### 6.2 Overall equipment effectiveness (OEE)

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

**Total effective equipment performance (TEEP)**

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

indicator of success. OEE can be illustrated by a brief discussion of the six metrics that comprise the system.

### 6.3 Factors Affecting Overall Equipment Effectiveness (OEE)

Packaging machinery manufacturers institute (PMMI's) 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.

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

## 6.4 Performance

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

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

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

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

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

## Information Sheet 7- Carrying out pre start checks

### 7.1 Introduction

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

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

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

### 7.2 Conduct Checks on Machine/Equipment

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

- Check that it is complete, with all safeguards fitted, and free from defects.
- The term 'safeguard' includes guards, interlocks, two-hand controls, light guards, pressure-sensitive mats etc.
- 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.

### 7.3 The Pre- and Post-Operation Equipment Inspection Checklist

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

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

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

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

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

## Operation Sheet 1- Conduct pre-start check of packaging equipment

**Sequence of operations for surface grinding:**

**Step1**. Wear appropriate personal protective equipment's

**Step 2**. Clean the equipment

**Step 3**. Check new signs

**Step 4**. Check different machine parts

**Step 5**. Check for damage on ground engaging tools

**Step 6**. Inspect the equipment components

**Step 7**. Maintain faulty parts

## Operation Sheet 2 Adjusting machine parts

**Sequence of machine adjustment:**

**Step 1.** Wear personal protective equipment's

**Step 2.** Make the machine off

**Step 3.** Inspect the equipment components

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

**Step 5.** Adjust part of the equipment identified

**Step 6.** Test the machine

| Lap Test | Performance Test |
|---|---|

Name……ID……..Date……

Time started: _____ Time finished: _____

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

**Task-1** Adjust machine components

**Task-2** Conduct pre-start checks

| LG #74 | LO2: Operate and monitor the process |
|---|---|

**Instruction sheet**

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

- Starting and operating packaging process
- Monitoring Operation of equipment and processes
- Identifying and reporting Variation in equipment operation
- Monitoring the Process
- Identifying out-of-specification process outcomes
- Maintaining work area
- Conducting work area
- Maintaining workplace records

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

- Start and operate packaging process
- Monitor Operation of equipment and processes
- Identify and reporting Variation in equipment operation
- Monitor the Process
- Identify out-of-specification process outcomes
- Maintain work area

- Conduct work area
- Maintain workplace records

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
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4. Accomplish the “Self-checks” which are placed following all information sheets.

## Information Sheet 1 Starting and operating packaging process

### 1.1 Introduction

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

### 1.2 Functions of Food Packaging

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

The four basic functions of a food package are:

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

### 1.3 Principles of Packaging

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

**Primary packaging:** It envelops and holds the food product

**Secondary packaging:** It is exterior to the primary packaging

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

## 1.4 Packaging and Food Safety

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

## 1.5 Types of packaging

The type of packing depends on various factors e.g. food item, the process of production, and quality of food, shelf life desired, transport considerations, etc. so it is important to consider the shape, size, 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

### 1.5.1Vacuum packing

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


**Figure 1.1. Vacuum packer**

### 1.5.2 Modified atmosphere packaging (MAP)

Food packaging in which the earth's normal atmosphere has been modified to extend a food's shelf life. A gas mix typically utilizing carbon dioxide, nitrogen, and oxygen gases. 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 1.2. Modified atmosphere packaging**

### 1.5.3 Blister packaging or over wrapping

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

**Figure 1.3. Blister packer**

### 1.6 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.

**Test I: Short Answer Questions**

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

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

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

**Information Sheet 2 Monitoring Operation of equipment and processes**

## 2.1 Packaging Machineries and Automation Systems

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

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

**Figure 2.1. Fruit juice conveyer**

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

| 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. Write equipment types on seed oil processing? (5 points)
2. What is wrapping? ( 5 points)

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

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

## Information Sheet 3 Identifying and reporting Variation in equipment operation

### 3.1 Identifying Variation in equipment operation

#### 3.1.1 Techniques of identifying equipment variations

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

#### 3.1.2 Steps of corrective action in response to variations

- **Define the Problem**

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

- **Interim Actions**

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

- **Root Cause Analysis**

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

- **Permanent Actions**

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

- **Verification**

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

- **Control**

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

- **Prevention**

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

| 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**

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

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

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

## Information Sheet 4 Monitoring the Process

### 4.1 Monitoring the process of packaging based on specifications

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

### 4.2 Selection Criteria for food Packaging Material

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

### 4.3 Recommendations for Immediate Action by Processors

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

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

### 4.4 Packaging Systems

Traditionally, juice have been packed in 15kg square tinplate containers. The other types of packages like plastic containers, lined cartons and flexible pouches have been recently introduced. Even though packaging has witnessed many changes, till today about 52% of juice continue to be traded in loose/unpacked form. This allows a lot of

scope to pursue the dangerous practice of adulterating the juice with less expensive and unhygienic varieties. Plastic packaging provides safe hygienically packed juice at competitive cost to consumers. It is extremely important that, whatever the packaging material used, it should be food grade and non-toxic. The product package compatibility is the starting point and shelf-life follows compatibility.

## 4.5 Packaging specifications and standards

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

## 4.6 Types of packaging

### 4.5.1 Primary packaging

In food grade PET (Polyethylene terephtalate) (or metal) bottles, hermetically sealed, of 1l, 3l or 5l according to the order. Bottles to have caps with tamper-proof devices. Weight of empty 1L plastic bottles. Supply in tin without cap (to open by piercing) not accepted.

Impermeability: No leakage under the pressure of 6 m high stacking.

Impact tests to be carried out on multiple packs ready for supply.

### 4.5.2 Secondary packaging

The one liter Polyethylene terephthalate (PET) bottles of juice to be packed in cartons containing 12 x 1L or 15 x 1L bottles. Containers to be separated from each other with cardboard inside the boxes. The carton of double corrugation, export quality, to withstand stacking 6m high for 6 month without deterioration. The sealing of the outer box is with glue or 50mm tape, capable of resisting a tropical climate (humidity and sunshine) for six months. Tape overlaps of 10cm minimum.

**Figure 4.1. Secondary packaging material**

### 4.5.3 Tertiary Packaging

Tertiary packaging facilitates the protection, handling and transportation of a series of sales units or secondary packaging in order to group everything into unit loads during

| 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. List check lists that packaging suppliers should be used? (5 points)
2. Mention types of materials that to be used in packaging? (5 points)
3. Write types of packaging? (5 points)

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

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

## Information Sheet 5 Identifying out-of-specification process outcomes

### 5.1 Introduction

**Out of specification out comes**

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

**The OOS investigation involves 2 phases:**

**Phase I: (laboratory investigation)**

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

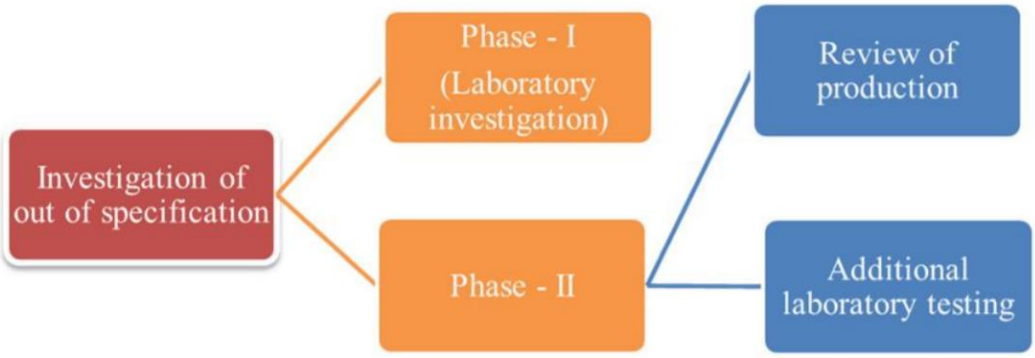


**Figure 5.1. Investigation of out of specification result**

**Phase II investigation**

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

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

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

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

## Information Sheet 6 Maintaining work area

### 6.1 Type of Workplace

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

### 6.2 Access

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

### 6.3 Maintenance

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

### 6.4 Work Layout

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

#### 6.4.1 Entry and Exit

Entries and exits are required to be safe to allow impeded access and egress for all workers, students and visitors including those with special needs.

In particular:

- Entries and exits should be slip resistant under wet and dry conditions
- Any walkways, boundaries or pathways shall be marked with 50mm wide with a contrasting color e.g. white or yellow

- Open sides of staircases should be guarded with an upper rail at 900mm or higher and a lower rail
- Handrail should be provided on or at least one side of every staircase
- Separate entry and exits for mobile equipment e.g. forklifts or trucks, and pedestrians are to be provided
- Power operated doors and gates should have safety features to prevent people from being stuck or trapped.
- Location of exits should be clearly marked and signs posted to show direction of exit doors to aid emergency evacuation.

## 6.5 Work Areas

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

In determining how much space is required, the following should be considered:

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

### 6.5.1 Floors and Other Surfaces

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

In general:

- Floors shall be free from slip or trip hazards e.g. cables, uneven edges, broken surfaces
- Floor surfaces shall have sufficient grip to prevent slipping, especially in areas that may become wet or contaminated
- Anti-fatigue matting, carpet, shock absorbent underlay, cushion backed vinyl shall be provided for workers where static standing occurs
- Carpet shall be properly laid without loose edges or ripples and should be well maintained
- Floors should be strong enough to support loads placed on them.

### 6.5.2 Workstations

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

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

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

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

### 6.5.3 Lighting

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

Emergency lighting is to be provided for the safe evacuation of people in the event of an emergency.

The following factors are to be taken into account:

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

### 6.5.4 Air Quality

Workplace are to be adequately ventilated which includes provision of fresh, clean air drawn from outside the workplace, uncontaminated from flues or other outlets and be circulated through the workplace.

Workplace inside buildings may have natural ventilation, mechanical ventilation or air conditioning.

**An air-conditioning system should:**

- Provide a comfortable environment in relation to air temperature, humidity and air movement
- Prevent the excessive accumulation of odours.
- Reduce the levels of respiratory by-products, especially carbon dioxide, and other indoor contaminants that may arise from work activities

- Supply an amount of fresh air to the workplace, exhaust some of the stale air as well as filter and recirculate some of the indoor air.

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

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

Natural ventilation may be assisted by mechanical ventilation.

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

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

### 6.5.5 Heat and Cold

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

### 6.5.6 Welfare Facilities

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

Workers are to be provided with:

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

| Self-Check – 6 | Written test |
|---|---|

Name…… ID…… Date…….

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

**Test I: Short Answer Questions**

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

***Note:*** **Satisfactory rating - 16 points** **Unsatisfactory - below 16 points**

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

## Information Sheet 7 Conducting work area

### 7.1 Introduction

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

### 7.2 Conducting work in accordance with workplace guideline

A safe work environment including:

- Facilities,
- Amenities and accommodation.

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

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

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

- Legislative Requirements
- Responsibilities
- Need assessment
- work environment
  - ✓ Welfare Facilities
  - ✓ Inspect and Monitoring

## 7.3 Legislative Requirements

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

- The layout of the workplace allows, and the workplace is maintained so as to allow, for persons to enter and exit and to move about without risk to health and safety, both under normal working conditions and in an emergency,
- Work areas have space for work to be carried out without risk to health and safety,
- Floors and other surfaces are designed, installed and maintained to allow work to be carried out without risk to health and safety,
- Lighting enables:
  - ✓ Each worker to carry out work without risk to health and safety, and
  - ✓ Persons to move within the workplace without risk to health and safety, and
  - ✓ Safe evacuation in an emergency,
- Ventilation enables workers to carry out work without risk to health and safety,
- Workers carrying out work in extremes of heat or cold are able to carry out work without risk to health and safety,
- Work in relation to or near essential services does not give rise to a risk to the health and safety of persons at the workplace.

## 7.4 Responsibilities

### 7.4.1 Facilities Management Division (or Equivalent)

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

- Are designed and installed according to company legislative and requirements
- Are inspected and maintained to ensure a safe level of hygiene.

### 7.4.2 Company Management and Supervisors

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

This includes:

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

### 7.4.3 Employees

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

### 7.4.4 Nature of Work Performed

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

### 7.4.5 Size and Location of the Work Area

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

### 7.4.6 The Composition of the Workforce

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

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

***Note:*** **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

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

## Information Sheet 8 Maintaining workplace records

### 8.1 **Record Keeping System**s

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

### 8.2 The purpose of records

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

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

The following make up the records of a Hazard Analysis and Critical Control Point (HACCP) Plan

- List of HACCP team and their assigned responsibilities
- Description of each menu item
- Flow diagram for each menu item indicating CCPs
- Hazards associated with each CCP and preventive measures
- Critical limits
- Monitoring procedures

- Corrective actions plans
- Record keeping procedures
- Procedures for verification of the HACCP plan

- Production process
- Variation of results

| 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. Makeup hazard analysis and critical control point plan includes? (5 points)
2. Write the purpose of recording? ( 4 points)

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

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

| LG #75 | 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:<br>• Identifying shutdown procedure<br>• Shutting down the Process<br>• Identifying and reporting maintenance requirements<br>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:<br>• Identify shutdown procedure<br>• Shut down the Process<br>• Identify and reporting maintenance requirements |
| Learning Instructions: |
| 1. Read the specific objectives of this Learning Guide.<br>2. Follow the instructions described below.<br>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.<br>4. Accomplish the “Self-checks” which are placed following all information sheets.<br>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). |

## Information Sheet 1 Identifying shutdown procedure

### 1.1 Introduction

Normal shutdown includes steps to render the systems safe, such as removal of hazardous process materials and inert (asphyxiating) gases. The systems might be cleaned as part of the shutdown; cleaning is often a process 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. 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 |
|---|---|

Name……ID…… Date…….

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

**Test I: Short Answer Questions**

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

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

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

## Information Sheet 2 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.

- **Cleaning of the machine**

Beyond clearing the line of product and residue, purging air, and cleaning filters, you should take the time to clean the machinery thoroughly during shutdown. Cleaning now will avoid unpleasant surprises at startup. For example, in the previous example where a company left 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. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

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

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

## 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 3.1. Maintenance check list

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

If necessary:

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

**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 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 3.2. Maintenance schedule

| Date | Tool | Maintenance check points | Signature | Maintenance required | Signature |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

| Maintenance Performed | 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 |
|---|---|

Name…… ID…… Date…….

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

**Instruction: I Short answer questions**

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

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

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