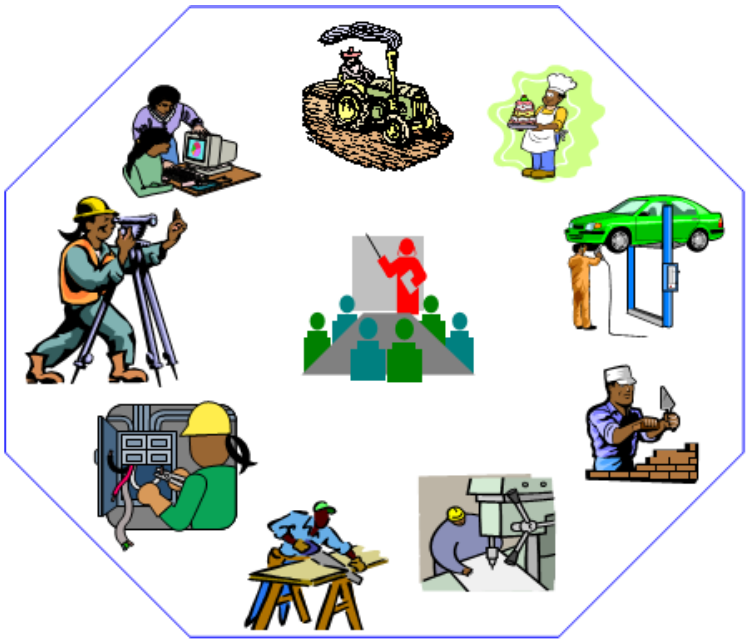
Fruit and Vegetable processing

Level-III

Based on May 2019, Version 2 OS and March, 2021, V1 Curriculum



Module Title: Setting up production and packaging line

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LG#11	LO #1- Prepare for line setup

Instruction sheet

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

- Confirming materials
- Confirming and fitting equipment for use
- Making tools and equipment required for line set up
- Identifying processing parameters and settings

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 materials
- Confirm and fit equipment for use
- Make tools and equipment required for line set up
- Identify processing parameters and settings

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)

Information Sheet 1- Confirming materials

1.1 Introduction

Confirming materials are firstly, confirming and checking specification of all spare parts of machine set up production lines a machine that mainly applicable to proper to works and available. Then, machines are inspection, pre- washing, sorting, crushing, preheating, extraction, Batch preparation, DE aeration, Homogenization, Pasteurization/sterilization, Aseptic filling, Cooling, packaging, labeling and storage functional to works available, etc.. One is hot filling 85-90 degree, another one is middle temperature 68-72 degree. The standard type of filling machine is which is integrated with washing filling and capping. For special production conditions, it can also add a sterilizing bottle. We can adjust them according to your requirements. The good hot juice filling machine is an option you can't miss.

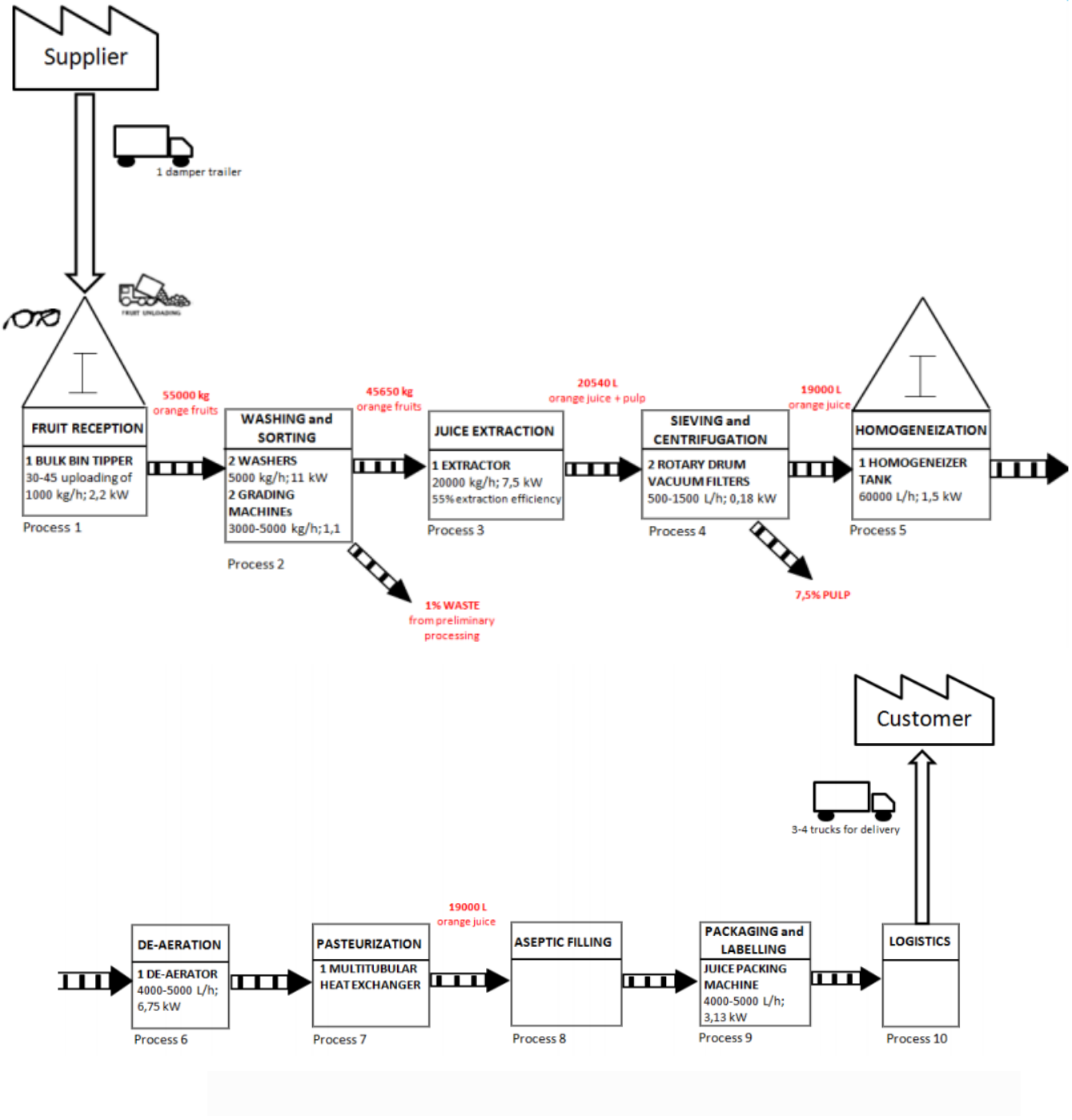

Figure 1.Processing line set up production for Fruit and vegetable processing flow sheet.

1.2 Raw material receiving

The raw materials after harvesting transported to processing rooms during such gap there may be a defect occur. In order to identify the problems if there is present in the raw materials, the organizations have their own monitoring or inspection systems for raw material receiving.

Among the parameters used to ensure that the raw quality during reception follow up the presence of (uniform of color, under or ripe fruit, Mould growth and insect infection, excessive dust, mud and foreign matter, cleanness of container and conveying vehicle etc.).

1.2.1 **Unloading**:

During unloading from the truck must be need set the unloading Iron frame system by joining iron frames from the edge of the truck inclined to the ground. Unloading the fruit from the truck by gently sliding crates between the inclined iron frames.

1.2.2 Inspection

Inspection is defines as "examination of a product, process, service, or installation or their design and determination of its conformity with specific requirements or, on the basis of professional judgment, with general requirement (leaves, stalks, moldy, rotten, damaged or unripe fruits
removed).

The first inspection of raw materials at the processing unit should include checks on:

- Maturity (over-ripe or under-ripe)
- Color
- Size or shape (for some products)
- visible mould or rots
- Serious bruising or cuts
- Presence of large amounts of soil, leaves or other materials.
- Remove mouldy, rotten, and badly damaged raw materials along with all visible foreign material (physical contaminants), e.g., leaves, stems, stalks, sticks, stones and rocks. Fruits and vegetables are washed in clean, potable water.

Process staff should be trained to remove any mouldy, rotten or badly damaged pieces before washing because these can quickly contaminate the wash-water and infect good quality raw materials. Careful inspection by trained staff is important for saving time and money later in the process. Poor quality raw materials produce poor quality final products because it is not possible to improve its quality by processing them.

1.2.3 Pre-processing storage

This stage has to be short or not more than 72 hrs as could as possible in order to avoid flavor losses, texture modification, weight losses and other deterioration that can be takes place over this period and the raw material temporarily stored in shade without any contact of sun light and protected from possible attacks of insect and rodents etc.

1.2.4 Pre-washing: Washing is performed with water sprays and using brushes to remove completely the dust particle.

1.2.5 Sorting: can be achieved by rolling the fruit in the sorting table to enables the removal of non-standard fruit with green parts, yellow coloured, damaged fruit etc. The selection of non-processed materials can be performed manually (by using human powers). Sorting is subjective it depends on the person sight and the ability to rapidly pick up of the damage fruit.

Figure 2.Sortor/classifier

1. **Washer and conveyor:** This equipment is suitable for washing various fruits and vegetables. The fruits are subjected to strong water agitation for removal of dirt. The washed fruits are then conveyed to the next state by a pickup conveyor.

. Type of soils presence on the orange may include spray residue, microorganisms, dust, Mould and rodents. Soil must be removed because any residue present in the canned product may cause it to be classed as adulterated (Are all surface contaminants (soil, pesticides etc.) removed)

. There for washing removes any soil microorganisms and other dirt. Washed the orange to remove soil and other foreign matters Rinsing also use in this step by applying pressurized water in the raw orange and brushes the product by the help of brush to efficiently remove any foreign matters attached in the fruit. Put defected orange and absolute wastes on the belt and convey it to the dump trailer. Whereas the pure orange dropped in to the chopper and size reduction involved.

Figure3: fruit washer and conveyer belt

2. Crusher/hammer

In special crusher equipment the tomato were crushed in to medium pieces without any separation of skins from flesh part.

4.1 Pulping and refining

Separate the liquid and fleshy portions from the seeds, skins, cores etc. through a series of two cyclones (pulper and finisher).The first cyclone (pulper) sieve-opening diameter of 0.7 mm, so that a good separation of pulp can be achieved. Second cyclone,(finisher) sieve opening diameter of 0.4mm, so that removal of impurities, and break down of the fiber of the pulp can be achieved with a result in a very fine texture in the finished product. During process Checked the wastes conveyed from the refiner by squashing the waste in hand palms; check weather waste is fairly free from excessive moisture. The by-product (passion fruit, skin and fibers) coming out from the pulper and the finisher conveyed through screw conveyer and dump on the dump trailer. To avoid insect and rodent attraction dump the waste collected on trailers in every 8-hour basis dump the waste in a place where compost is prepared and clean the trailers before the next use.

3. Pre-heater

The crushed fruit immediately pre heated at 82-90°C for about 15 second in order to facilitate the extraction, dissolves pectin substances and contributes to the maintaining of vitamins and natural pigments. Pre heat is important to sufficiently separate the juice from skin and to destroy pectin enzyme to permit efficient pectin. Pre- heated the crushed fruit immediately through a tubular pre-heating unit at a temperature of 82-90^{o}c for about 15 second to destroyed pectin enzyme and to permit efficient extraction of juice and pectin. Pre heat also facilitates the separation of skins from pulp and helps to preserve the natural color of products. This treatment performed with jacketed tubular heat exchanger that the product and steam is never cross each other and the product passes through stainless steel tubes.

Figure 4: tube heat exchanger

4. Extractor

The pre heated and crushed fruit sent to the two refiners to extract the juice and waste part (skin and fibers). The first refiner (cyclone pulper) sieve-opening diameter is between 1.2-0.7 mm, so that a good separation of pulp can be achieved. The second cyclone (finisher) sieve-opening diameter of 0.3-0.4 mm, so that removal of impurities and break down of the fibers of the pulp can be achieved with a result in a very fine texture in finished product. Multiple effect evaporators were used to concentrate the fruit and vegetable in to desired total soluble solid (brix). The juice from juice receiving tank pumped in to double effect evaporator for temporary storage. In double effect evaporator the product maintains previous holding temperature from pre-heating with range of 55-70 ^{o}c and the heat from the juice removed by vacuum pressure. When the double effect evaporator tank is filled, open the pneumatic valve to allow interring the juice in to single effect evaporator.

Single effect evaporator removes the water from the juice under vacuum pressure of 42-60 bars and processing temperature 65-70 ^{0}c until the desired concentrated product is obtained. Continue evaporation until density is produced (22-24 ^{o}brix) that can be measured by hand Refracto-meter. When the product has reached the required

concentration then pump it through pressure relief valve to the collection vat pasteurizer.

- Checking temperature
- Checking pressure
- Checking time
- Checking total soluble solids

5. Batch preparation

In this section, the in mixer tank prepared in three batches with each batch size of 900 liters, and then adds refined table salt (sodium chloride) with amount of 3.6 kg for each of three batch tanks. The ingredient added in to the tank agitated properly with electric motor source stirrer. The role of salt is here to add flavors and for the purpose of preservation.

Figure 5: mixing tank

6. Homogenizer:

Process, occurring in homogenizing tanks, is necessary for obtaining a homogeneous product. Homogenization is done for mincing of pulp particles with above 100 bars in order to avoid product separation in to two layers. In these steps, also product gain dispersion and have the same consistency in each layers of product in the container. The purpose of homogenization in fruit juice is to have the same consistency and immersion of particle with one another to fit the consumers' organoleptic quality (taste) by avoiding product coagulation.

Figure 6: homogenizer

7. Pasteurization/sterilization

Sterilization treatment applied on juice to avoid flat sour spoilage, which caused by heat resistant strains of bacillus and destroy the spores of heat resistant flat sour organism by flash sterilizing. The juice heated at 121- 122^{o}c for 42 seconds and follow cool to 97^{o}c before filling. Before filling the juice temperature should be, reduce in to 97^{0}c in order to prevent stuck burning, which is resulting discoloration and burned flavors on juice.

Pasteurization assures the microbiological stability of the setup product. For this purpose, the paste coming out from concentration equipment is passed continuously in a tubular pasteurizer at a temperature.

The filled and seamed can Conveys in to the net pasteurizer cooler and process with spray hot water for about 3 to 5 minute at temperature of 90-92^{o}c prior to water cooling.

And spray cold water on the can until the temperature of can reaches 42^{o}c to avoid stock burning which results in discoloration and loss of flavor on the caned product. The time required for products to pass through net pasteurizer is 45 min

Figure 7: sterilizer

8. **De-aeration:** dissolved oxygen is reduced with decrease in temperature and pressure. DE aerated the juice under vacuum pressure to remove dissolved and occluded air. Since heating fruit juice containing dissolved and occluded air impairs the retention of vitamin C. The air inside in juice may be oxygen, carbon etc., are not eliminated in to acceptance level they may causes to fermentation, oxidation and swage of the packed can.

Figure 8: de-aerator.

9. Aseptic filling/packaging

Aseptic filling mean that the package and the products are sterilized separately. Thus helps to save steam economy used because filled can consumes more steam than empty can to sterilize properly. The filling temperature of fruit juice should kept below 97 ^{o}c and then pasteurized up to 100^{o}c in order to eliminate any contaminations present during lid feeding and sterilized can feeding in to dosing machine. In this step the pasteurized product is pumped in to filling and dosing machine.

The filling and dosing machine filled the products in the sterilized can with minimum fill of the container to be 90% by volume and gross headspace to be 6-10% by volume. The machine fills 17-28 cans of 410gm and 850gm per minute respectively. Filling required careful attention the can must be clean, sterilized by steam and the correct weight of product must be filled, under filled cans will be under weight and the head space will be to large resulting in too much air being left in the can. Over filling may lead to seams being strained during processing, two ends becoming distorted and budge. Over filling also affects heat penetration in the can, and may lead to spoilage breakouts.

- ✓ Checking cooling

10. Coder

Feed the canned product to the data marker machine for printing in readable and on appropriate format. Before starting data marking feed the necessary information's in to the data marker machine to give shelf life time of the product. The information's like lot number and shifts are feed in every 8 hour whereas, months in 1 month interval. The time gap between manufacturing date and expired date should be 24 month (PLC) or filler digital display.

11. Can dryer

To remove moisture and dirt from the surface of container, dry the can completely by blowing atmosphere air at the end of tunnel exit.

Temporary storage/incubation

In this operation collect the corrected marked cans in neat plastic craters and transport to précising storage place by using hand pallet truck whereas, un marked cans collected and back to reprinting. The products stay in the incubation stores for 21 days. This day indicates the final date at which any changes in the pack could be observed and the health cans could be packed in to corrugate carton whereas, the swelled packages are disposed as waste. Swelling is happened due to the reason of over fill, linkage, residue of gas and spoiled by microorganisms.

12. Cooling

The filled cans are cooled until the final temperature reaches 30^{o}c.

Filled cans do not need further pasteurization because the bacteria that have potentially contaminated the fruit juice during filling are easily destroyed at 95° C due to natural juice acidity.

After following the above schematic flow sheets, the juice must have the following main characteristics;

- natural black color;
- taste
- uniformity (without pulp sedimentation);
- total soluble solids: 5% minimum;
- total soluble substances (by Refracto-meter): 4% minimum;
- Vitamin C: 15 mg/100ml minimum

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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: Write short Answer Questions

1. One of the following is true about physical hazards.(2pts)

   A. metals B. Salmonella C. poor temperature control during storage Insecticide and pesticide

2. List at least 6 types of line set up production? (5pts)

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

Note: Satisfactory rating ≥ 7 points **Unsatisfactory <7 points**

Information Sheet 2- Confirming and fitting equipment for use

2.1. **Confirming and fitting equipment for use**

Confirming is the mechanism of validating or accepting the equipment with respect to the specification as correctly work.

The purpose of confirming is:

- To give approval machine with respect to the specification
- To ratify or treaty the functionality of equipment or machine
- To make firm or firmer to resolve the problem
- To know and manage types of equipment and machine
- To give validation and assurance
- To remove doubt

All parameters and control operations used within the food industry, and their respective periodicity monitored by a technician. The manual must declare general personal hygiene and training aspects, facility as well as production flowchart, and pest and quality control programs. The control periodicity must be established in the SOPS generally required for a food processing industry:

- Hygiene of premises, machines and tools, which define the entire cleaning management process, its maintenance, sanitizer concentration, time and periodicity.
- Water portability, which emphasizes water standards required in all process and its portability, with periodic analyses.
- Hygiene and health of food handlers. The conduct and physical state of food handlers are an essential aspect of food quality. This SOP emphasizes the Program for training periodicity and employees conduct required in a processing area.
- Waste management, referring to management of residues generated in the industry.
- Preventive maintenance and calibration of equipment's, which indicates the need for maintenance of equipment and premises in the processing area.
- Integrated management of vector and urban pests, which defines potential pests and vectors, as well as the methods and their periodicity to avoid presence of pests in the processing area.

- Selection and reception of raw materials, packaging and ingredients. Important item that safeguards the traceability of all inputs used in fruit pulp production. This is one the most important fundaments of food product safety.
- Food gathering program. Food companies are also responsible for withdrawal products from market if the food expiration date is exceeded. This SOP establishes the final management of unsold products.

Hazard Analysis Critical Control Points (HACCP) provides guidance on how to identify biological, chemical and physical hazards in a particular food processing line and how to control them at the Critical Control Points (CCP) throughout production. Some HACCP implementation attempts in food area, and minimally processed fruit and vegetables, have already been published, and revealed that the use of HACCP as a control system tool is a natural trend however, the fruit processing industry is still exempt from HACCP, but this requirement will tend to be gradually imposed over the years.

Investigations aim to discover existence of hazards to health and integrity of consumers. It is performed by inspecting raw materials and all relevant production chain stages, including product consumption by consumers. These investigations are focused on:

- Microbiologically susceptible foods that favor microbial growth and toxin production;
- Pathogenic microorganisms or toxic substances;
- Inadequate heat treatment, that is, inadequate time-temperature combinations;
- Inadequate procedures after heat treatment;
- Environmental conditions that allow the transfer of pathogenic microorganisms or toxic substance to foods through air, water or other vectors

Microbiological analyses should be carried out in stages of sanitization, peeling, pulping, heat treatment or preservative addition and freezing, in order to minimize significant microbial proliferation or existence of physical or chemical hazards.

In general, safety management may be assumed as the sum of risks management that is usually administered by the government at a macro level. The government supervises and establishes IQSs for food products, while the food production sector executes the risk management, not only in terms of application, but also maintenance through quality tools

such as GMPs, SOPs, HACCP, and ISO etc. This ensures that good quality food products will be available to consumers.

2.2. Implementing control measures

Workplace health and safety laws require the highest order control be applied. Higher order machinery and equipment risk controls are preventative by nature, are effective and durable for the environment it is used in, and deal directly with the hazard at its source. Intrinsic hazards that may arise because of the nature of the organization operations and activities, products or services, plant and machinery, and the work environment itself may require specific action plans based on the hierarchy of controls. Controls may also include documented policies and procedures. The four ways are based on the hierarchy of controls provided for the OHS Regulations.

The controls adopted should always be the highest level that can be reasonably attained. That is you should eliminate the hazard and if that is not reasonably practicable then you should consider changing equipment and materials and so on. This is an expressed requirement of the OHS Legislation. Separation is a simple and effective machinery and equipment risk control and may be achieved by distance, barrier or time and temperature. Managing health and safety hazards is key to operational excellence in the work place – regardless of its size. Where possible, you should always try to remove or eliminate hazards from the work line setup production, for example by using a different process, or changing the way a job is done. If it is not possible to control the alarm, to determine the most effective measures to control work line setup production and to minimize risk.

Design or re-organize to control hazards

It is often cheaper and more practical to control hazards at the design or planning stage of a product, process or place used for work For example, resist trip hazards on the floor or dispose of unwanted chemicals.

Substitute the hazard with something safer

If it is not reasonably practical to control the hazards and associated risks, you should minimize the risk

Isolate the hazard from people

This involves physically separating the source of harm from people by distance or using barriers. For example, Introducing a strict work area, using guard rails around exposed edges and holes in the floors, using remote control systems to operate machinery, enclosing a noisy process from a person and storing chemicals in a fume cabinet.

Use engineering controls

An engineering control is a control measure that is physical in nature, including a mechanical device or process, Elimination and minimizing hazards. For example this can be done through the use of machine guards, effective ventilation systems and setting work rates on a roster to reduce fatigue.

Use administrative controls

Administrative controls are work methods or procedures that are designed to minimize exposure to a hazard. Establish appropriate procedures and safe work practices such as; limit exposure time to a hazardous task so that fewer employees are exposed, routine maintenance and housekeeping procedures, training on hazards and correct work methods and use signs to warn people of a hazard.

Environmental prevents employee exposure to hazards.

Figure10: Hazard control action

- **Use Personal Protective Equipment (PPE)**

Provide suitable and properly maintained PPE and ensure employees are trained in its proper use. Examples include gloves, earplugs, face masks, hard hats, gloves, aprons and protective eyewear. PPE limits exposure to harmful effects of a hazard but only if workers wear and use the PPE correctly.

Where it is not possible for emissions to be controlled at their source, or removed or reduced through effective ventilation, extraction or diversion, the use of personal protective equipment (PPE) as a final measure must be considered to ensure safety. PPE is a lower order control and can only be used where higher order controls are not possible or are not totally effective. Selection and use of PPE requires careful consideration, as there are many different types that reduce the risk of injury of contact or exposure to a hazard. Lower order machinery and equipment risk controls, such as personal protective equipment. The action of moving parts may have sufficient force in motion to cause injury to people. Must be provided with safe access that is suitable for the work they perform in, on and around machinery and equipment. A stable work platform, suited to the nature of the work that allows for good posture relative to the work performed, sure footing, safe environment and fall prevention (if a fall may occur), is a

basic requirement. Incorrect use of PPE, or purchasing inappropriate PPE, can contribute to serious workplace incidents. PPE that is uncomfortable, restrictive or heavy may create secondary hazards, and, as a result, constant supervision may be necessary to ensure it is used effectively. Once the controls have been implemented then the effectiveness of the controls must be monitored and reviewed.The proper use of protective equipment in the process requires training, monitoring and encouragement and the following precautions should be followed.

Gloves and boots should be washed daily using detergent and rinsed with clean water. Depending on the amount of soiling, coats should be cleaned either daily or weekly at a laundry. Hats and hairnets should be cleaned as required

Personal Protective Equipment (PPE).Examples include: safety glasses face shields, ear plugs, and protective footwear, Protective gloves, hats, hairnets, coats…

Types of Protective Clothing	Description	In picture
	Protect against harmful in	

Gown	Cloth protection	
Glove/Protect glove	Protect hand (skin) against harmful	
Rubber boots	Protect feet ,ankles, and lower legs from harmful	
Head protection	Head protected	
Eye glass	Protect eye	

Table: description of personnel protective equipment (PPE)

Tools and equipment	**Description**	**In picture**
First aid kit	Protect against happened cutting and	
Thermometer		
Refracto meter	Measuring degree ^{o}BRIX	
PH meter	Measuring acidity	
Blender	Juice extraction	
Measuring cylinder		

Table2. Tools and equipment

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: Choose the best answer (2 points)

1. a control measure that is physical in nature, including a mechanical device or process

   A. engineering controls B. administrative controls C.A&B D.all

Test II: Write short Answer Questions

1. Write the personal hygiene equipment(3pts)

. **Note: Satisfactory rating ≥ 5 points Unsatisfactory <5 points**

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

Information Sheet 3- Making tools and equipment required for line set up

3.1 Making tools and equipment required for line set up

Fruit and vegetables processing equipment should be conformed to support good manufacturing practices. The first step in line set up process equipment requires a process line or the specific way of equipment be designed. The pieces of equipment in a line must be identified, such as conveyors and elevators that connect with various unit operations of assembling the unit operations for all material and energy entering and leaving each step or unit operation. Setting up equipment on a production line basically amounts to combining a number of basic elements, each of which is described in a separate “how-to” guide. You should review each guide for key concepts and as a lead-in to the related knowledge base with its specific topics and techniques. The pieces of equipment in a line must be identified, such as conveyors and elevators that connect with various unit operations of assembling the unit operations for all material and energy entering and leaving each step or unit operation.

3.2 Line setup tools and equipment

- sorter
- Washer
- Blancher
- Plate heat exchanger
- sterilization
- De-aerator
- Aseptic packaging

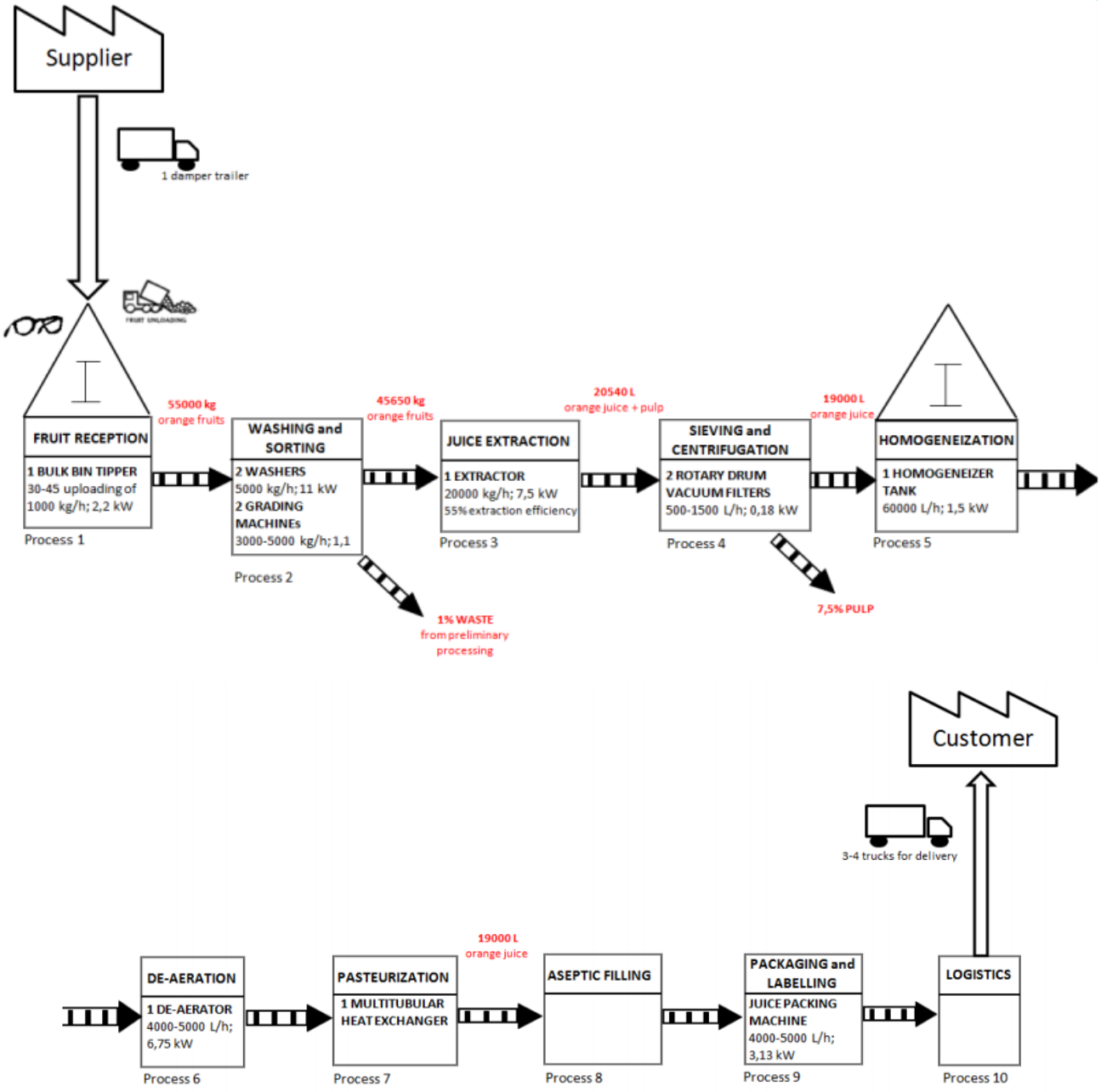

Figure 1.Processing line set up production for Fruit and vegetable processing flow sheet.

The individual workstation

W**orkstations:** a point of interface between employees and the product or related equipment. A workstation can be either:

- Stationary at a single machine or workbench, or
- Flexible on a moving line.
- Sensor machine
- blancher

In either case, the starting point for setting up a production line understands the optimal interface for the product relative to the person doing the work. Defining the optimal interface should be undertaken for each step of the production process, which in turn establishes the design objectives for much of the equipment needed for the line. Employees need easy access to the product, they need to see, and they need to keep in a productive working position. They need to access tools and materials as readily as possible. Thus, this critical step should be taken before even thinking about the equipment.

See How to design a workstation and the list of specific issues and options in the Workstation best practices knowledge base.

Material handling systems

Materials need to be moved to and from each workstation, whether separate workstations or integrated on a moving line:

- Separate machines or workbenches connected by delivery of batches of materials, such as by forklift trucks or manual carrying of totes.
- A single line, with workstations connected by single piece flow, such as with a conveyor or sliding surface for the product.

The basics of material handling are generally well known. However, it is difficult for personnel in a given workplace to be familiar with the array of methods that are used elsewhere.

Material handling is best considered as a whole system throughout a facility, rather than addressing a single location. By following the complete flow and taking into account the

whole chain of transfers, it is easier to recognize wasted steps and incompatible handling methods. Often these techniques inherently benefit the employees' ability to do their jobs well, but the techniques can be optimized by deliberate attention to human factors.

Typically in most work places material handling is highly mechanized, but with gaps in predictable locations, such as the final step of delivering items to the point of use. At this step, materials are often handled manually, often with a need to lift items to the correct height and orient properly for use. The result is a loss of efficiency and high risk for back injuries and other disorders.The concepts of lean generally place considerable stress on improved material handling. See How to improve manual material handling and the related Material handling knowledgebase.

The machine-operator interface

From the perspective of this website, a manually operated machine is a specific type of workstation. It requires special attention because the size and function of machines can create barriers for attaining the optimal human interface.

Furthermore, machines typically have unique points of operation that materials must be placed into and removed from, often by hand. Consequently, it can be difficult to fully integrate machines into the production line and may require special efforts for material handling.

Smaller machines are easier to integrate fully into a moving line for efficient production, especially with insights and guidance by the best practices available on this site. Larger machines are more difficult, but improvements are often possible.

Changeovers of machines also involve special issues, in part because the components that need to be switched out are heavy and, in contrast to completely manual work where the human provides more flexibility, the machine components must be set up precisely within the mechanisms of the rest of the machine.

The section interface and the separate Machine address the special issues involving machines.

Hand tools

Hand tools are used in every operation, but not always the best ones for the task at hand. The phrase “right tool for the right job” is an excellent one, but it is not always clear how to determine what the right tool is.

The sections here related to hand tools provide guidance and examples on the proper selection and use of hand tools. Furthermore, the information suggests ways to modify existing tools and design new ones, whether simple homemade devices or commercially available ones.

Related issues are supports and holders for tools along with their storage at the point of use.

Maintenance

An often-neglected issue when designing machines or setting up production areas is giving sufficient consideration for maintenance, whether repairs, cleaning, or tune ups. Clearance and access should ideally be provided, along with equipment features that facilitate the ease of maintenance.As mentioned equipment and tools at below then take for dyer equipment's,Preparing, cutting, washing, drying, peeling and packaging of food. Take as an example of solar dryer machine.

Drying (osmotic dehydration) is equipment that an oldest preservation technique of products and it is an energy-intensive process. High prices and shortages of fossil fuels have increased the emphasis on using alternative renewable energy resources. Sun drying is still widely used in many tropical and subtropical countries. Sun-drying is the cheapest method, but the quality of the dried products is far below the international standards. The introduction of suitable drying technologies can only achieve the improvement of product quality and reduction of losses. Different types of solar dryers have been designed, developed and tested different regions. The major two categories of the dryers are natural convection and forced convection solar dryers. In the natural convection solar dryers, the airflow is established by buoyancy induced airflow, while in forced convection solar dryers, the airflow is provided by using fan either operated by electricity/solar module or fossil fuel. Natural convection solar drying has advantages over forced convection solar drying in that it requires lower investment though, it is challenging to control drying temperature and the drying rate may be limited. Due to low cost and simple operation and maintenance, natural convection solar dryer appears to be the apparent option and popular choice for drying of fruit and vegetable products. Sun drying has low capital and operating.

There are very many different types of dryers and it is not possible to describe each in detail in a manual of this type. Design considerations are described in books listed in Annex A. The size of dryer needed to dry a given weight of food per day can be calculated by assuming the following drying areas for different types of product:

- $1m^2$ is needed for around 2 kg of less dense products such as shredded cabbage.
- $1m^2$ is needed for around 4 kg of moderate density products and
- $1m^2$ is needed for up to 6 kg of chopped fruits.

Solar dryers do not require spare parts or routine maintenance. However, ultra-violet light causes the plastic sheeting to deteriorate and it must be replaced periodically depending on the type of plastic used and the strength of the sunlight. Polythene needs replacing each year, UV resistant polythene and polyester every 2-3 years and UV-resistant polyester every

3-5 years. Drying trays should be washed using detergent and rinsed with clean water after each use.

The dryer process of fruits and vegetables is given as

Figure 11.Solar dyers.

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: Choose the best answer (5 point)

1. Which one of the following is true about machine-operator interface?
   A. Consequently, it can be difficult to fully integrate machines into the production line and may require special efforts for material handling.
   B. It requires special attention because the size and function of machines can create barriers for attaining the optimal human interface
   C. Smaller machines are easier to integrate fully into a moving line for efficient production, especially with insights and guidance by the best practices available on this site D. All can be answer.
2. _____equipment that an oldest preservation technique of products and it is an energy-intensive process. High prices and shortages of fossil fuels have increased the emphasis on using alternative renewable energy resources.
   A. Drying B. milling C. freezing D. A & C

Test II: Write short Answer Questions

1 Materials need to be moved to and from each workstation, whether separate workstations or integrated on a moving line.(3points)

Note: Satisfactory rating ≥ 8 points unsatisfactory <8points

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

Answer Sheet

1. _____

Information Sheet 4- Identifying processing parameters and settings

4.1 Identifying processing parameters and settings

A process Parameters in machining cutting velocity, Feed. There process

Parameters machining are all those parameters that are inherent to any machining operation and should have a suitable finite value to smooth and efficient removal of materials. Such parameters directly affect machining performance.

Processing parameters include power or current applied to the heating element, weld pressure, peak temperature, and dwell time (time held at peak temperature or current, boiler pressure, energy, time, relative humidity and velocity.

Types processing parameter

- Batch system
- continuous system
- CIP/SIP system
- continuous stirred tank reactor
- plug flow reactor
- plug power/energy

Features of process parameters

- It must be primary factor i.e., there should not be any other factor that controls it.
- It must be supplied during machining.
- It should have a finite value.
- It should directly affect machining performance.
- It can be varied externally without changing the work-tool combination.

Process parameters differ from influencing parameters

Influencing parameters include all those parameters that can directly or indirectly influence the machining operation. Thus all process parameters are influencing parameters. Apart from velocity, feed and depth of cut, there are many other parameters that can influence performance considerably; however, they are not inherent to machining process. A list of such parameters relevant to conventional machining is provided below.

- Cutting environment (i.e., application of coolant)
- Tool geometry including nose radius
- Work material
- Tool material
- Tool coating
- Screw drive
- dosing
- Work and tool setting, etc.
- Air washer machine

Figure 9: time, temperature & relative humidity.

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: Choose the best answer (2 point)

1. _____are Parameters machining are all those parameters that are inherent to any machining operation and should have a suitable finite value to smooth and efficient removal of materials.

A. Parameters machining B. Screw drive C. Allen keys D. none

Test II: Write short Answer Questions

2. Write the types of processing parameters.(4points)

Note: Satisfactory rating ≥ 6 points Unsatisfactory <6 points

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

Answer Sheet

1. _____

Information Sheet 5-Legislative requirements for production and packaging

5.1. Legislative requirements for production and packaging

Production and Packaging is the science, art and technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also refers to the process of designing, evaluating, and producing packages. Packaging can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use. Packaging contains, protects, preserves, transports, informs, and sells. In many countries it is fully integrated into government, business, institutional, industrial, and personal us. The main purpose of packaging is to ensure that the product is inside a container along with packing materials to prevent movement and to cushion the produce (plastic or molded pulp trays, inserts, cushioning pads, etc.) and for protection (plastic films, waxed liners, etc.). It needs to satisfy three basic objectives. During the product forward conveying process, it can automatically group the product into package, so as to save time and enhance packing efficiency. Friendly interface and convenient parameter setup, absolutely an easy-to-operate machine. The ideal model of middle-speed heat-shrinking packager in the domestic market

- Contain product and facilitate handling and marketing by standardizing the number of units or weight inside the package.
- Protect product from injuries (impact, compression, abrasion and wounds) and adverse environmental conditions (temperature, relative humidity) during transport, storage and marketing.
- Provide information to buyers, such as variety, weight, number of units, selection or quality grade, producer's name, country, area of origin, etc. Recipes are frequently

included such as nutritional value, bar codes or any other relevant information on traceability.

- Its specialization and knowledge in the Produce sector by offering the widest range of packaging solutions on the market, thanks to the possibility of choosing between different packaging systems.
- Technical requirements of the product (for protection against light, crushing, air, moisture etc.)
- The design (for promotional and marketing requirements) and the relative cost and availability of different types of packaging.

A well-designed package needs to be adapted to the conditions or specific treatments required to be undertaken on the product. For example, if hydro cooling or ice-cooling need to be undertaken, it needs to be able to tolerate wetting without losing strength; if product has a high respiratory rate, the packaging should have sufficiently large openings to allow good gas exchange; if produce dehydrates easily, the packaging should provide a good barrier against water loss, etc. Semi-permeable materials make it possible for special atmospheres inside packages to be generated. This assists in maintaining produce freshness. Packaging consists of…

- Consumer units or prepackaging
- Transport packaging
- Unit load packaging or pallets
- Consumer unit or prepackaging. Normally, this contains the quantity a family consumes during a certain period of time (300 g to 1.5 Kg, depending of product). Materials normally used include moulded pulp or expanded polystyrene trays wrapped in shrinkable plastic films. Plastic or paper bags, thermoformed PVC trays, bottles, etc. Onions, potatoes, sweet potatoes etc. Colors, shapes and textures of packaging materials play a role in improving appearance and attractiveness.

- Specific names that must be given to different types of ingredients that are exempt from the law
- The use of words such as best before and sell by
- The declaration of alcohol content on spirit drinks
- Locations of the name of the food, the sell-by date and the net weight (they must all be in the same field of vision when a customer looks at the label)
- The visibility of information and the ability of customers to understand it (including the relative print sizes of different information)
- Claims and misleading descriptions, especially about health-giving or tonic properties, nutritional advantages, diabetic or other medicinal claims Specifications of the way in which certain words such as flavor, fresh, vitamin etc. The legal requirements are that a label should contain the following information. Name and address of the producer
- Name of the product
- List of ingredients (in descending order of weight)
- Net weight of product in the package
- A 'use-by' or 'sell-by' date

5.2. Transportation and Storage

As finished fresh-cut product be stored and transported under conditions that will protect the food against physical, chemical, and microbiological contamination. If feasible, that raw whole produce not be stored with finished product and finished product be transported in clean, sanitary vehicles. We also recommend the following practices:

- Keeping finished products refrigerated at temperatures appropriate for the product during storage, transportation, and display for sale to minimize the potential for growth of microbial pathogens

- Equipping refrigerated transportation vehicles and storage rooms with accurate temperature measuring devices, preferably including a temperature recording function

If a recording temperature device is not used, we recommend that a min/max thermometer, i.e., a thermometer that shows the range of temperatures attained over a set time period, be used.

- Shipping fresh-cut produce products on a FIFO basis to minimize storage time
- Ensuring that the equipment in refrigeration vehicles is designed to circulate cold air uniformly throughout the vehicle while taking the load layout into consideration
- Placing fresh-cut produce products in storage facilities and transportation vehicles in a manner that allows for proper air circulation
- Transporting and storing fresh-cut produce products in vehicles and containers that are dedicated to carrying food products and have been treated by a process that is effective in destroying vegetative cells of microorganisms of public health significance
- Inspecting transportation vehicles and containers for debris, soil, and off-odors prior to loading to increase their suitability for transporting fresh-cut produce
- Loading and unloading fresh-cut produce in a manner that minimizes the potential for damage and for microbial contamination

Quality assurance record format				
No	Product name	Batch code	Drum No	Reason for non-conformity
1				
2				
3				
4				

Table: 3 QA record formats.

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: Choose the best answer (2 point)

1. _____The science, art and technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also refers to the process of designing, evaluating, and producing packages.

A. production & packaging B. Name of the product C. Transport packaging D. all

Test II: Write short Answer Questions (5point)

1. The legal requirements are that a label should contain the following information.

Note: Satisfactory rating ≥ 5 points **Unsatisfactory <5 points**

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

Answer Sheet

1. _____

LG#12	LO #2- Set up the line for operation

Instruction sheet

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

- Identifying and confirming cleaning requirements and status
- Inspecting equipment's
- Selecting and adjusting machine settings
- Entering processing or packaging parameters
- Checking adjusted equipment performance as required
- Carrying out pre-start checks
- Completing line set up production and packaging schedules
- Reporting any maintenance requirements
- Conducting works with environmental guidelines.
- Notifying relevant personnel for set up completion

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 and confirm, clean requirements and status
- Inspect equipment's
- Select and adjust machine settings
- Enter processing or packaging parameters
- Check adjusted equipment performance as required
- Carry out pre-start checks
- Complete line set up production and packaging schedules
- Report any maintenance requirements
- Conduct works with environmental guidelines

- Notify relevant personnel for set up completion.

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 and confirming cleaning requirements and status

1.1 Equipment *status* and cleaning requirements

Equipment status is an operational status of a piece of equipment consisting of a status indicator and status character for health. Cleaning is the complete removal of foreign materials using appropriate detergent chemicals under recommended conditions. Before you attempt to clean an area, there are several considerations that need to be made. You need to understand the scope of cleaning that is required, at what time you will be able to clean an area and the equipment and chemicals that you will need to complete the job. 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.

The main status of equipment before confirming for operation is:

- Safety and healthy
- Inspection
- Electrical safety
- Maintenance types

1.2 Cleaning

Cleaning is the process of removing food and other types of soil from surfaces as belt, dust, glass or cutting board. Cleaning is done with a cleaning agent that removes food or other substance. The right cleaning agent must be selected because not all cleaning agents can be used on food-contact surfaces. (A food contact surface is the surface of equipment or machine utensil that food normally comes in to contact.

1.3 Methods of cleaning

There are some methods of cleaning in the food process such a:

1.3.1 Mechanical or manual

Manual cleaning do not require mechanized or electronic equipment

- Sweeping: a broom, a dustpan, a trash bag and a stocked pubic-space cleaning cart.
- Dusting: Micro Fiber Cloths, Feather duster.
- Damp dusting: Wet mopping / damp mopping: floor cleaner, wet mop & bucket or mop- wringer trolley, squeegee, & detergent solution.
- Manual polishing: Use proprietary polish for each type of floor or surface,
- Spot Cleaning: solvents, cleaning agents, etc.

1.3.2 Mechanical Cleaning: these utilize equipment powered by electricity as well as mechanical equipment. Vacuum cleaning: Caution signs, a stiff broom, wet/dry vacuum cleaner with attachments, & a mild detergent for wet cleaning if necessary.

Spray buffing: buffing machine, spray bottle, detergent, & finishing solution.

Polishing: floor machine or brush to remove some soil, Vacuuming or dust- mopping

Dry Cleaning: removed non-aqueous medium using a chemical solvent other than water by a washing machine and clothes dryer.

Methods of Chemicals

Sanitizing:Treatment of cleaned surface with chemical or physical agent to destroy disease/spoilage causing organisms. Reduces total waste or residue to a safe level.

Cleaning agent

Detergents: These are cleaning agents, solvents or any substance used to wash table wares, surfaces, and equipment. Example: soap, soap powders, cleaners, acids, volatile solvents and abrasives.

Solvent cleaners: commonly used on surfaces where grease has burned on. Ovens and grills are examples of areas that need frequent degreasing. These products are alkaline based and are formulated to dissolve grease.

Acid cleaners: Removing mineral deposits and detergents cannot eliminate such as scale in washing machines and steam tables, lime buildup on dishwashing machines and rust on shelving. (Ex.: phosphoric acid, nitric acid, etc.) These products vary depending on the specific purpose of the product.

Abrasives: used to remove heavy accumulations of soil that is difficult to remove with detergents, solvents and acids. These products must be carefully used to avoid damage to the surface being cleaned.

Other chemicals used for cleaning or sanitizing kitchen equipment and utensils are:

- Ammonia
- Chlorine and soap
- Carbolic acid disinfectants

Types of Equipment's

- Brush fruit cleaning machine for passion fruits(rounder mango yellow color) & mangoes
- Brush clearing machine for watermelon
- Brush cleaning machine for carrot vegetable
- Brush cleaning machine for citrus fruit

Cleaning may be carried out with soap and clean water. All the surfaces and corners should be washed and dried thoroughly, using plenty of clean absorbent paper, or clean cloth, to ensure that every corner is completely dry. Any remaining moisture can promote the growth of bacteria. If the canopy is made of clean it with soap and water, but do not use abrasive compounds.

- Store bags in tidy stacks set up on pallets, ensuring that there is a space of all-round the stack
- Store any empty or old bags and fumigation sheets on pallets, and if possible in separate stores
- Keep the store free of rubbish in order not to provide the animals with any places to hide or nest! Bum or bury it!
- Keep the area in the vicinity of the store free of any stagnant water and ensure that rainwater is drained away, as it can be used as source of drinking water.

Figure 12.Manual cleaning

Figure: 13. Mechanical clean

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: Write short Answer Questions

1. Write define of cleaning?(5 point)
2. List important of cleaning machine (3 point)

Note: Satisfactory rating ≥ 8 points unsatisfactory <8 points

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

Answer Sheet

1. _____

Information Sheet 2- Inspecting equipment's

2.1. Inspecting equipment's

Inspection is usually meant that, at certain stages in the course of production, a comparison is made between what has actually been produced and what should have been produced. The standard of reference may be a specification, drawing or a visual quality standard. The check made must be appropriate to the job and must be made with suitable measuring instruments. Inspectors should not waste time checking things that do not matter or fail to do a check that is important. Things that are unlikely to go wrong need little checking and those which are difficult to hold within limits will need a considerable amount of attention. It is a misconception that the inspector alone is responsible for quality. In spite of these, if the job is still wrong, no amount of inspection will put it right

Equipment has to be imported, the following points should be considered when ordering equipment:

- Specify exactly what is required (many manufacturers have a range of similar products).
- Give the throughput required of food to be processed
- Where possible, give other information (operational manual)

It is recommended that each inspector carry the appropriate inspection equipment, which should include but is not limited to the following items:

Identification

- Designation card
- Inspection badge
- Business cards

Equipment

- A pen without a cap
- Bound notebook
- Non-porous clipboard that can be easily sanitized
- approved flashlight
- Calibrated light meter
- Calibrated thermometer with steel shaft
- Sampling supplies, sterile and non-sterile as required (e.g., Whirl-Packs, gloves, cooler with ice packs

.

Different forms of inspection

According to production flow, the inspection listed at below

- Incoming inspection
- In-process inspection
- Final inspection

In-process inspection

In-process inspection aims to prevent products of unacceptable quality from being manufactured. It provides data for making decisions on the product (accept or rework or reject), as well as on the process (run or stop). In-process inspection can take the form of:

- First-piece inspection
- Patrol inspection
- Operator inspection
- Last-piece inspection
- Stage inspection

Final inspection

Final inspection and/or testing is done after manufacture has been completed, with the object of making sure that the goods concerned are satisfactory for dispatch to the customer or maybe to another department for the next operation

The four types of quality inspection services:

A **Pre- production inspection**: tells the buyer which kind of raw materials (or components) will be used. Factories are often suspected of lowering their costs by purchasing substandard materials, and this can be disastrous for the buyer.

The pre-production inspection can also focus on the processes followed as production starts. Sometimes this can also be critical, as Chinese factories very often cut corners and do not respect the buyer's blueprints (e.g. patterns for cutting fabric are received from the buyer, and they are modified to make the process easier and faster).

It is the most useful and the most under-rated tool at the disposal of importers, who often only rely on final inspections.

The final (also called "pre-shipment inspection") is by far the most common type of QC check. It takes place once 100% of shipment quantity is finished and at least 80% is packed, so it can be a real random inspection (this is not exactly the case if quality is checked earlier earlier) and suppliers cannot play games.

The container, like the pre-production inspection, it is seldom used. But it can be a worthwhile option in some specific cases.

Quality Control: - Quality control is the testing of completed products to uncover defects, and reporting to management who make the decision to allow or deny the release of the product within the broader Quality Management System

Quality improvement system

The quality system encompasses the need for regular and frequent discussion and analysis of findings from feedback, monitoring reports and reviews in order to identify desirable or necessary improvements in operations or performance.

Total quality control

Total quality control also called total quality management, is an approach that extends beyond ordinary statistical quality control techniques and quality improvement methods. It implies a complete overview and re-evaluation of the specification of a product, rather than just considering a more limited set of changeable features within an existing product. If the original specification does not reflect the correct quality requirements, quality cannot be inspected or manufactured into the product. For instance, the design of a pressure vessel should include not only the material and dimensions, but also operating, environmental, safety, reliability and maintainability requirements, and documentation of findings about these requirements.

Quality control system emphasis on three aspects:

- Elements such as controls, job management, defined and well managed processes, performance and integrity criteria, and identification of records
- Competence, such as knowledge, skills, experience, and qualifications
- Soft elements, such as personnel integrity, confidence, organizational culture,
- Motivation, team spirit, and quality relationships.

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: Write short Answer Questions

1. List a least three types of inspection? (2 point)
2. Write four types of quality inspection services (3 point)

Note: Satisfactory rating ≥ 5 points unsatisfactory <5 points

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

Answer Sheet

1. _____
2. _____

Information Sheet 3- Selecting and adjusting machine settings

3.1. Selecting and adjusting machine settings

Adjusting is correcting the equipment setting or parameter like temperature, pressure time and humidity throughout the process of line process.

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.

Adjustment is:

- Pressure
- Time
- Temperature
- Humidity

Adjustment of Machine Operation

1. **Safety check**

Check and make sure there is no foreign matter on:

- The conveyer belt
- Elevators
- Packaging machine

2. **Switch on the power**

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

Basic operating principles of equipment

- and related accessories used by the system, including equipment adjustment points, status and purpose of guards, and range and location/alignment requirements of sensors and related feedback instruments

Self-check 3	Written test

Name…… ID…… Date…….

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

Part I: Write short Answer Questions

1. How to adjusting machine? (5 point)
2. Mention the type of machines?(3point)

Note: Satisfactory rating ≥ 8points **Unsatisfactory < 8 points**

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

Answer Sheet

1. _____
2. _____

Operation Sheet 1– Procedures of operating machine

Procedures for production

Material required: Regardless of the particular risk reduction measures selected for a particular machine, there are some general safe operating rules that must be observed.

1. Restrict access to shops and individual pieces of equipment/machines to authorized operators.
2. Wear Personal protective equipment: which protect from hazard in work activity
3. Clean machine: remove waste(hazards)
4. Collect all wastes and dispose it.
5. Prepared to production.
6. Clean machine step by step used in activity(tools, equipment and PPE)
7. Maintain machine performance(if necessary)
8. Record each activity in each
9. Reporting to problem.

LAP TEST 1	Performance Test

Name……. ID……..

Date…….

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **1** hour. The project is expected from each student to do it.

Task-1: Selecting and adjusting machine settings.

Information Sheet 4- Entering processing or packaging parameters

4.1. Process Parameters

It also called a process variable) are certain measures that refer to status of the process (their values indicate whether the process meets the plan or it needs adjustment). In order to obtain effective execution of the process its parameters should stay under continuous control. The simplest examples of parameters you can find in a manufacturing process are pressure, temperature, and chemical composition – anyone of these may have its desired value that is called asset-point that regulates proper functioning of process elements and operations, while if a parameter deviates from its set-point (goes beyond the acceptable level of variance), then probably a process tends to fail, hence special automatics or human operators should intrude into this process to adjust it and prevent upset. Process parameters are extremely important in controlling a process, therefore should be accurately measured and monitored throughout process run – it is an essential part of process management and maintenance of its efficiency, therefore process parameters, as dynamically changeable features, are controlled with a help of technological sensors mounted at critical areas of a process, along with implementation of special methods and equipment to adjust them.

Processing and packaging are the two important phases of operations in the food industry. The final phase is the packaging stage. A great deal of automation strategies are constantly being utilized in every phase of processing and packaging. The correct packaging enables processors to pack fresh and fresh-cut fruit and vegetables and extend their shelf life. The important parameters for this shelf life extension are temperature, moisture and a modified atmosphere (oxygen, carbon dioxide and ethylene). If both temperature and packaging are optimal, ageing of fruit and vegetables can be slowed down significantly.

The machine operator should be following the following procedures to enter parameters during the packaging process.

- Plug the power
- Set the peak temperature specification for the packing machine
- Set the peak pressure with respect to range
- Set humidity and moisture of the machine to reduce or increase
- Set the time of packing
- Set speed of cutting machine and heat sealing
- Flush out the air and replace by the nitrogen gas.
- Homogeneity of the preparation

Critical quality parameters:

- Preservation of the fruit identity
- Mouth feel, texture
- Color and flavor
- Additive nutritional value

The following are among the more important general requirements and functions of food packaging materials/ containers:

- Technical requirements of the product (for protection against light, crushing, air, moisture etc.
- The design (for promotional and marketing requirements) and
- The relative cost and availability of different types of packaging.
- They must be non-toxic and compatible with the specific foods
- Sanitary protection
- Moisture and fat protection
- Gas and odor protection;
- Light protection
- Resistance to impact
- Transparency
- Ampere profess
- Ease of opening
- Pouring features
- Reseal features
- Ease of disposal
- Size, shape, weight limitations
- Appearance, printability
- Low cost
- Special features.

	Packaging production report format					
	Request NO	Request date	Requested by	Request packaging materials	Received by	Work order No & date
	System failure registered					System ID & name
	Packaging materials check list					
	Remarks:					
	Packed			Required actions		
	Checked by:_____ Received by:_____			Date:_____ sign_____ Date: _____sign_____		

Figure: 14. Packaging Record formats

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: choose the best answer

3. Which one of the following is invalid about the food packaging materials(2pts)

A. light presence B. Moisture and fat protection C. transparency D. all

Test II: Write short Answer Questions

1. Write define processing parameter.(2 point)
2. Write define processing packaging line(3 point)
3. List at least six functions of food packaging materials/ containers (3points).

Note: Satisfactory rating ≥ 10 points **Unsatisfactory <10 points**

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

Answer Sheet

1. _____
2. _____
3. _____

Information Sheet 5- Checking adjusted equipment performance

5.1. Checking adjusted equipment performance

Checking is testing or evaluating machine/equipment performance for safely works before start the processed to the work.

Adjusting is the correctness of the machine/equipment efficiency and effectiveness before the work start in order to achieve the desired fit or result. Performance and measure the packaging line efficiency throughout packaging machine line if the equipment is operating at maximum hammering speed and feeding rate. These data points give you a measure of a piece of the packaging system but not necessarily an overall view of how effective the equipment/machine.

Measuring machinery health by performance monitoring has the potential to give warning of a developing failure through the changing levels of a suitable parameter being measured, thereby indicating a change in condition of a component, machine or system.

There are several types of machines

- Sealing machine
- Filling machine
- Scrapping
- Wrapping
- Coding (PLC) and labeling.

The critical point adjusted equipment performance

- Equipment performance monitoring.
- Equipment condition assessment.
- Equipment health monitoring

5.2 Condition Monitoring and Process Analysis

Most machine and process characteristics which affect

- availability
- capacity
- quality
- safety
- Risk and cost can be continually evaluated throughout an asset's lifetime

This is essential in identifying impending failure and will be applied to critical areas identified in the reliability plan. The current state-of-health of process plant is important information related to current information, diagnosis and prognosis of various defects, and predicted useful life in the optimization of safety, quality and high production rates. There are the obvious functions of monitoring and controlling the process for reasons of safety and product specification. Additionally, there is invaluable information to be gained from the process parameters that can give an understanding of the current health of the asset.

5.3. Checking Equipment Performance

Equipment's for which Performance Monitoring surveys may be required on a routine basis include the following items:

Equipment Calibration **Equipment Calibration**

- Perform initial calibration
    - ✓ use calibrators or standards
    - ✓ follow manufacturer's instructions
- Determine frequency of routine calibrations

Performance Evaluation

- Validate performance with parallel samples
- Establish stability for temperature- controlled equipment

Checks equipment

Monitor instrument parameters:

- periodically, daily, weekly, monthly
- after major instrument repair

Examples:

- incubator temperatures
- wavelength calibration
- autoclave temperature chart

Figure: 14 manual cleaner

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: Write short Answer Questions

1. Most machine and process characteristics which affects.

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

Note: Satisfactory rating ≥ 5 points unsatisfactory <5 points

1. _____

Information Sheet 6- Carrying out pre-start checks

6.1 Carrying out pre-start checks

The solves the problem of searching for the tools in different places in the company, which leads to a decrease in searching time and unnecessary transportation within the Standard layout helps the operator to collect the required tools for setup at once or twice depending on the type of setup and tools used for setup. Standard layout helps the operators to identify or collect the information of missing tools or damage tools and easy to place an order for new tools required in future. This even helps to arrange or place the new arrival tools arriving in the tool storage.

This standard layout must be designed depending on the type of manufacturing and tools used. It is important to carry out a series of checks before using a piece of machinery. This is particularly important in situations in which a number of people use the same machine. Larger companies and organizations usually have a system of checks, and a maintenance department that will deal with reported defects. Individuals working alone or in small teams will be responsible for checking and maintaining their own machines. Operator should be able to follow a checklist to ensure that they complete all the necessary checks.

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 its complete line, with all safeguards fit and free from defects

- Restore all power to the machine and equipment before operation
- Check all machine settings
- Check efficiency of the machine, equipment and tools
- Check the safety and health of the equipment to be used before operation

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 and health.

Operators always have to check the following parameters before going to manipulate the operations:

- Parameter setting (pressure, temperature, time and humidity and flow procedure
- Identify the faulty conditions to face the work
- Analyze maintenance requirements and
- Identify hazards types

. **Conduct checks on machine/equipment**

Before allowing someone to start using any machine you need to think about what types of risks come across the work and how can be managed that risk. So, you should:

- Check all the equipment is complete with all safe guards, fitted, and free from defects.
- Check the parameters that should be appropriately work and all equipment is in safe operational condition.
- Provide the right safeguards (from supplier by law) and inform buyers of any risks.
- Produce a safe system of work for using and maintaining the machine.
- Require the inspection of critical features, before maintenance, where Deterioration would cause a risk.
- Look at the residual risks identified by the manufacturer in the Information/instructions provided with the machine and make sure they are included in the safe system of work.
- Choose/make sure the right machine/equipment for the job.
  - ✓ safe for any work that has to be done when

- ✓ setting up,
- ✓ during normal use,
- ✓ when clearing blockages,
- ✓ when carrying out repairs for breakdowns, and
- ✓ during planned maintenance;

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

6.3 packaging system components

Packaging component" means any individual assembled part of a package such as, but not limited to, any interior or exterior blocking, bracing, cushioning, weatherproofing, exterior strapping, coatings, closures, inks and labels.

Carry the pre-setup to avoid the following.

- Long time for collecting tools from storage.
- The misplacement of tools.
- Proper follow up for the new tools required and damaged tools.
- Decreases or eliminates buffering of return tools.
- Check for leaking or pooled fluid around and under the machine before switch off or plug off the machine from cables or breaker
- Inspect the operator compartment and clear away any debris or obstructions.
- Properly switched off, isolated or locked-off before taking any action to
- Blockages,
- Any control measures to minimize the risk of injury
    - ✓ reduce mechanical damage optimizing the process diagram;
    - ✓ reduce rejects not meeting the maturity requirements;
    - ✓ reduce biological hazards
    - ✓ reduce cracked fruits

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: Write short Answer Questions (4point)

3. Write the Operators always have to check the following parameters before going to manipulate the operations:(2point)
4. Carry the pre-setup to avoid the following.(4point)

Note: Satisfactory rating ≥ 6 points Unsatisfactory <6 points

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

Answer Sheet

1. _____

Information Sheet -7 Completing line set up production and packaging schedules

7.1 Introduction

Completing line set up is checking machine for processing and ready for work. Machine is having its own pumping system to connect the machine with the main / buffer tank of the product. . All settings to be done on the machine interface) keypad which is provided on the electrical control panel the volume to be filled is measured by the measuring devices, which consist of multi piston positive displacement volumetric device.

All the line setup is completed from raw bulk materials receiving machine to packaging finished product in the container/machine part of your operation and every process between packaging machine manufacture and installed in the most appropriate equipment/machine.

7.2 Line setup production or packaging

The Packaging line consists of a group of packaging machine parts with control parameters that make together as a line with respectively to sequence. Typically the separate machine design and build by different component and all equipment linked together and controlled as a unit which receives product, container, lids, adhesive, labels, wrapping material that turns packaging will form, fill, seal and deliver a complete package.

Checking point suggestion

- ✓ Checking for leaks in the system
- ✓ Checking machine failure
- ✓ Checking the machine is functional
- ✓ checks of electrical connections
- ✓ Checks on the belt tension.
- ✓ Build-in CIP system to make clean easy

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: Write short Answer Questions (6points)

1. Write processing step production line.
2. Write define what is completing line set up production and packaging.

Note: Satisfactory rating ≥ 6 points Unsatisfactory < 6 points

Answer sheet

1. _____

2. _____

Information Sheet -8 Reporting any maintenance requirement

8.1 Equipment Maintenance

Equipment maintenance is any process used to keep in reliable working order. It may include routine upkeep as well as corrective repair work. Equipment may include mechanical assets, tools, heavy off-road vehicles, and computer systems. The resources needed to keep it all in good repair will vary by type. For instance, repairs made on heavy construction equipment won't look the same as those performed on automated food processing machines. Establishing a preventive maintenance program helps to ensure that all equipment functions as intended. Equipment failure requiring maintenance activities during production may increase the risk of microbial contamination.

Preventive maintenance includes periodic examination and maintenance of equipment such as valves, gaskets, pumps, screens, filters, and heat exchanger plates. We recommend that a firm develop appropriate plans of action in case important equipment, such as refrigeration equipment, disinfectant delivery systems, power systems, or alarm systems, malfunctions. Designing machines or setting up production areas is giving sufficient consideration for maintenance, whether repairs, cleaning, or tune ups. Clearance and access should ideally be provided, along with equipment features that facilitate the ease of maintenance. Equipment may include mechanical assets, tools, heavy off-road vehicles, and computer systems. The resources needed to keep it all in good repair will vary by type. For instance, repairs made on heavy construction equipment won't look the same as those performed on automated food processing machines.

The critical points to need maintenance requirements

- Tool Cost
- Labor
- The machine listed
- Parts
- material

Any industry that uses any kind of equipment uses equipment maintenance. Some major examples include the following:

- Food processing: Heavy machinery, mobile equipment, and handheld tools used in food processing all require equipment maintenance.
- Plastics manufacturing: Plastics manufacturing plants use a wide range of heavy and lightweight equipment, all of which needs regular servicing.
- Steel mills: Maintenance workers in steel fabrication plants service equipment ranging from hot rollers and furnaces to portable tools.
- Restaurants: The various types of equipment used in commercial kitchens need to be kept in working order to provide reliable service. Regular equipment maintenance also helps restaurants maintain regulatory compliance.
- Construction: Keeping heavy mobile equipment, handheld power tools, and safety gear in good repair is key to a construction company's efficient operation.
- Automobile manufacturing: Fabricating and assembling vehicle parts requires finely tuned equipment. Production is best when that equipment is kept in good repair.

- Workshops: Workshops use a variety of tools to produce various items, such as woodworking, metal products, and blown glass. Given the exacting standards of this industry, their tools need to be kept in top condition.

Recommend the following practices:

- Performing maintenance and calibration of equipment by appropriately trained personnel we recommend that maintenance personnel who work in the processing or packaging areas comply with the hygiene requirements for production employees.
- Installing, calibrating, and maintaining temperature measuring or recording devices as necessary to ensure accuracy
- Frequently sharpening knives, if used, including retractable knives, and disinfecting before use we recommend that knives be replaced if damaged or if they cannot otherwise be maintained in a sanitary condition.
- Frequently inspecting cutting blades and belts during processing operations for damage, product residue build up, or cleaning needs .We recommend that blades be removed and cleaned separately, and remaining equipment parts disassembled (if possible) and cleaned on a regular basis.
- Operating metal detectors in accordance with the manufacturer's instructions and checking for proper functioning at least daily to ensure effective detection of metal and removal of affected product We recommend that procedures be in place, such as a the use of metal detectors during packaging operations, to minimize the possibility that metal ends up in finished product packages.
- Calibrating safety control devices that are essential for maintaining the proper level and activity of wash water disinfectant, at a frequency recommended by the manufacturer and documenting this activity on the instrument calibration forms/logs

- Examining air filters for both intake air and compressed air and changing at least as often as the manufacturer specifies, or more frequently if a problem is indicated, such as evidence of filter fouling or perforation
- These machines are not fitted with safety devices to stop the motor if they are opened. Ensure that the machines are isolated from the mains electricity supply before dismantling them for cleaning or maintenance

8.2. Workplace information

Workplace information is recorded clearly and accurately in the format and at the time required by the organization. The maintenance file is a compilation of various documents and records relating to operation, maintenance, inspection, testing evaluation, and repair of the equipment. The methods selected for establishing adequate information retention and retrieval shall be determined by the equipment custodian. An electronic recordkeeping system may be used. If computerized maintenance management system. Keep dated reports of operational tests and the rated load test as long as the device is available for use. Inspection records should be retained in a format and location that provides for ease in accessibility. Maintenance file information should provide a source for comparing present conditions with past conditions to determine whether existing conditions show a trending pattern of wear, deterioration, or other comparable factors that may compromise safe, continued use of the equipment. Length of record retention shall be determined by the equipment custodian's established maintenance program.

Maintenance(service) requision format

Request NO	Request date	Requested by	Request maintenance	Received by	Work order No & date
System failure and registered					System ID & name
Maintenance check list					
Remarks:					
Installed/repaired spare parts			Required actions		
Checked by:_____ Received by:_____			Date:_____ sign_____ Date: _____sign_____		

Figure: 15. Maintenance report

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: Write short Answer Questions

1. The critical points to needs maintenance requirements (3points)
2. Write what is Equipment maintenance mean.(2point)

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

Note: Satisfactory rating ≥ 5 points Unsatisfactory < 5 points

Answer sheet

1. _____
2. _____

Information Sheet9-Conducting works with environmental guidelines

9.1. Conducting works with env/t al guidelines

The work environment, facilities and amenities are provided for basic health and the purpose of maintains food safety and minimizing environmental impacts. The goal of food packaging is to contain food in a cost-effective way that satisfies industry requirements, consumer desires & maintains food safety.

Packaging is a way to protect the product and facilitate marketing and distribution to manufacturers, distributors, and consumers. The process of bringing product and package together is usually the last step of the product manufacturing operation, although assembling packages within other packages or further units often follows product packaging. Successful performance of the packaging function depends first on recognizing that the result must serve marketing and distribution purposes. No compelling necessity dictates that product manufacturing and packaging is anything but sequential unit operations of a business enterprise.

These include items such as:

- Biodegradable
- Oxygen
- Unwanted waste/garbage
- Greenhouse gas emission
- Atmospheric pressure
- First aid facilities/rooms (refer to first aid guidelines).

- Performing environmental sampling on both food contact and non-food contact surfaces (e.g., drains)
- Determining the appropriate target pathogen, test locations,
- Nature of Work performed
- units in identifying, evaluating, and correcting health and safety hazards;
- Developing programs for the safe use of hazardous radiological, biological, and chemical substances and lasers;
- Providing training materials, assistance, and programs in safe work practices;
- Providing guidance on effective emergency management and business continuity programs, and providing emergency response services for incidents involving hazardous materials;
- Providing fire prevention, inspection, engineering and systems maintenance services; and
- Hazardous waste management and disposal services.

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.

All workers are to apply rules when performing their tasks.

2. Plan work to minimize environmental harm
3. Immediately report and respond to environmental incidents
4. Work strictly in accordance with any environmental approval.
5. Manage all waste and contaminated materials appropriately
6. Minimize noise and emissions
7. Regularly inspect the site and works

Self-check 9	Written test

Name…… ID…… Date…….

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

Test I: Write short Answer Questions (4point**)**

1. Write what is Packaging mean.

Note: Satisfactory rating ≤ 4 points Unsatisfactory <4 points

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

Answer Sheet

1. _____

Information Sheet- 10- Notifying relevant personnel for set up completion

10.1. Notifying relevant personnel for set up completion

In the event of a firm-initiated recall, if a firm believes its product is the act, we request that the firm immediately notify the appropriate FDA, food standards and additives, laboratory sampling analysis & analysis Contaminants & toxins district office and that the notification include:

- The identity of the product involved (i.e., an adequate description of the type of food to include brand name and specific variety, date of releasing the food, the lot or code number or other identifier of the implicated product, the quantity and how the food is packaged);
- The reason for the recall and the date and circumstances under which the product deficiency or possible deficiency was discovered.
- An evaluation of the risk associated with the product the total amount of implicated product units processed and the time span of processing.
- The total amount of product in inventory and the total amount of product distributed.
- The distribution information including the number of direct accounts and, where necessary, the identity of the direct accounts.
- A copy of the firm's recall communication, if any has issued, or the proposed communication if none has issued.
- the proposed strategy for conducting the recall

- The name and telephone number of the firm official who should be contacted concerning the recall
- Understanding how to operated machine works and efficiency
- Have ability to solving problem and attention to his own work
- Have understood instruction and follow production set up in detail.

10.2. Documentation and records

Recommend as a general practice that food processors maintain records sufficient to reflect important product information and practices. Such documentation can be helpful to the processor in several ways. First, such records help ensure consistency of processing operations and end-product quality and safety. They are more reliable than human memory, and they are a useful tool to identify operational areas where inconsistencies occur and further employee training may be needed. Second, maintaining adequate documentation and records of processing operations is important if a trace back investigation of product is ever needed. Recommend that records be retained at the processing plant for products were prepared unless a longer retention time is required under a relevant law or regulation. Records are most useful when they begin by including the date and time, name of person(s) who completed the record, and the activity or production station being recorded.

Records that may be kept for most food processing operations include the following:

- Temperature control records
- Equipment monitoring and maintenance records
- Calibration records
- Sanitation records
- Product processing batch records
- Corrective action records
- Pest control records
- Distribution records

- Inspection records (e.g., incoming product, facility, production area)
- Microbiological contamination records (e.g., food contact surfaces, equipment)

Self-check 10	Written test

Name…… ID…… Date…….

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

Test I: Write short Answer Questions (8point)

1. Write the food processing operations or criteria.
2. Records that may be kept for most food processing operations include the following.

Note: Satisfactory rating ≤ 8 points unsatisfactory <8points

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

Answer Sheet

1. _____
2. _____

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