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Ministry of Labor and Skills

Fruit and Vegetable processing

Level-I



Based on November 2021,Version-3 Occupational Standard

Module Title: Using Food Processing Tools and Equipment

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Introduction to the module

This Module cover the skills, knowledge and attitudes required to adjusting, dismantling, assembling and finishing of items or components, and the finishing, cutting, scraping of metallic and non-metallic material to size and shape in fruit and vegetable processing. This includes simple tapping and threading and routine maintenance of hand and power tools.

LG#6 LO#1 Follow workplace procedures

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

- Finding out job requirement
- Identifying and follow appropriate procedures
- Complete all reports
- Recognizing and report hazards and anything unusual

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:

- Find out that required.
- Identify and follow appropriate procedures
- Complete all reporting as required.
- Recognize and report Hazards and unusual

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

Finding out job requirement

Job requirements are the job qualifications and skills necessary for a certain position. Job requirements are a crucial part of both job descriptions and job postings. Job requirements should be carefully crafted to encompass all the most important attributes, skills and knowledge of your candidate persona. In Fruit and vegetable processing industry experts perform the following activities such as washing, peeling, sorting, and grading slicing, preserving, freezing agricultural products. Food processing industry job requires may include specific skills, types and amounts of work experience, personal qualities, educational credentials, professional certifications, or areas of knowledge anybody just before going to accomplish by:-

- Safe work environment
- Appropriate Work procedures
- Specific tools and equipment for that specific job or activity
- Operator or technician should have knowledge ,skill ,and positive aptitude

The golden rule for writing the content of your job requirements is very simple - Here are the 8 most important job requirements types:

- Work experience - types and amounts (years) of work experience
- Skills (soft skills and/or technical skills)
- Specific knowledge
- Education level and type
- Professional licenses, accreditations and certifications
- Personal qualities and attributes
- Languages
- Physical abilities.

Responsibilities for Machine Operator

- Set up machinery for operation
- Start machinery and make adjustments to machinery when necessary to improve performance

- Operate machinery and equipment according to instructions
- Troubleshoot issues and perform maintenance
- Perform quality control, follow reporting and recordkeeping procedures, and report problems to supervisor
- Comply with all safety and health regulations

Clean machinery and maintain cleanliness in work area

https://www.youtube.com/watch?v=-Kd-_qlS96w(access date 23/01/2023)

Skill needed for Agro food processing machine operators

- Physical co-ordination and manual dexterity.
- The ability to work steadily and swiftly.
- The ability to do routine tasks yet remain alert and flexible.
- The ability to understand written specifications and instructions.
- Mechanical aptitude.

These skills are necessary for the role of fruit and vegetable processing.

- **Maintain cutting equipmen**t: Maintenance of the cutting equipment (knives, cutters, and other elements).
- **Check quality of fruits and vegetabl**es: Check fruits and vegetables received from suppliers; ensure highest quality and freshness.
- **Clean food and beverage machinery:** Clean machinery used for food or beverage production processes. Prepare the appropriate solutions for cleaning. Prepare all parts and assure that they are clean enough to avoid deviation or errors in the production process.
- **Execute chilling processes to food products:** Carry out chilling, freezing and cooling operation processes to food products such as fruit and vegetables, fish, meat, catering food. Prepare food products for extended periods of storage or half prepared food.

Ensure safety and nutrition qualities of frozen goods and preserve products in accordance with specified temperatures.

- **Use food cutting tools:** Trim, peel and slice products with knives, paring or food cutting tools or equipment according to guidelines.
- P**repare fruits and vegetables for pre-processing**: Perform basic preparations of fruits and vegetables such as inspecting, cleaning, sorting and grading. For instance, select fruits and vegetables that are adequate to be processed and eliminate those of inadequate quality.



Figure 1.1 Machine operator

https://www.youtu be.com/watch?v=2uKraiYVRoc(access date 23/01/2023)

1.2.**Identifying and follow appropriate procedures**

Standard operating procedure (SOP) is a set of step-by-step instructions compiled by an organization to help workers carry out complex routine operations. Operating procedures are normally used to control activities such as transitions between products, periodic cleaning of process equipment, preparing equipment for certain maintenance activities, and other activities routinely performed by operators. Procedures May include:

- All operations performed in accordance with procedures.
- All relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

1.2.1 SOP for handheld analogy refractometer

To take a measurement with a handheld analogy refractometer, follow these steps and read the manufacturer's instructions:

I. Calibrate the refractometer with a standard solution before use. Since the reading will be affected by temperature changes, it's best to calibrate at the temperature of the test environment. If this is not possible, correction charts may be used. Some refractometers have automatic temperature correction (ATC), a feature that allows the instrument to automatically correct for temperature differences.
II. Place a small amount of liquid (usually 2–5 drops) on the prism, and secure the cover plate. This will evenly distribute the liquid on the prism.
III. Point the prism end of the refractometer toward a light source and focus the eyepiece until the scale is clearly visible.
IV. Read the scale value at the point where the dark and light portions meet.



Figure 1.2 calibration of Refrectometer

https://www.youtube.com/watch?v=K6GR343eycE(access date 23/01/2023)

1.2.2 Flow diagram for tomato processing

The tomato processing plant is used to process raw tomatoes and convert them into puree, ketchup, sauce, and powder. It not only processed the tomatoes but also has an option for cleaning and sorting bad tomatoes. The process ensures that only quality tomatoes are used in making finest tomato ketchup, puree, and sauce.



Figure 1.3. Tomato processing flow diagram



Flow chart for making Mango Pickle



Figure 1.4 Flow chart for making Mango Powder

1.3. **Complete all reports**

Records must be kept providing information for planning maintenance and replacement activities so that they occur at the proper time. Proper maintenance management of equipment requires a detailed inventory of all major items, including among other things information on manufacturer, model, year and number, and a list of the parts required for normal service and major repairs respectively. The reports include:

- Facility inspections
- Worksite Assessments
- Job Hazard Analysis
- Job Briefings
- General Daily Activity

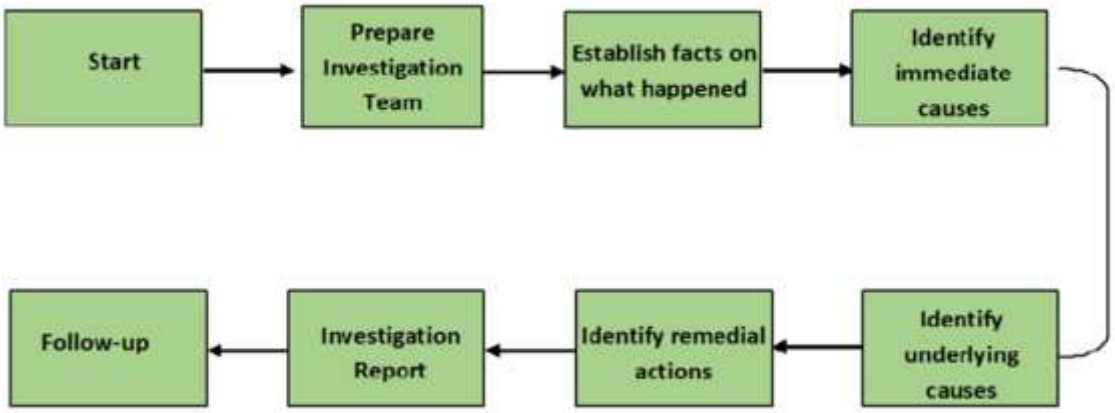


Figure 1.5. Hazard reporting procedure

1.4.**Recognizing and report hazards and anything unusual**

Unsafe or faulty tools are identified and marked for repair according to designated procedures before, during and after use. The equipment and procedures but sufficient to recognize abnormal operating conditions and alert the appropriate individuals. Checking conditions of operating equipment has a vital role for the operator's safety, quality of a product and for equipment safety. Reporting and documenting these incidents help modify the existing safety regulations. Here are Document the procedure in a step-by-step format that is easy to understand and the communicate to your employees what the process is and where they can find the procedure to reference at any time..

- Common causes of equipment failure.
- Improper operation.
- Failure to perform preventive maintenance.
- Too much preventive maintenance.
- Failure to continuously monitor equipment.
- (bad or no) reliability culture.

Mechanical hazards

Machinery and equipment have moving parts. The action of moving parts may have sufficient force in motion to cause injury to people

- When assessing machinery and equipment for possible mechanical hazards, consider: machinery and equipment with moving parts that can be reached by people
- machinery and equipment that can eject objects (parts, components, products or waste items) that may strike a person with sufficient force to cause harm
- machinery and equipment with moving parts that can reach people, such as booms or mechanical appendages (arms)
- Mobile machinery and equipment, such as forklifts, pallet jacks, earthmoving equipment, operated in areas where people may gain access.

Emergency services and witness statements are also recorded for more detailed report in:-

- Parameter setting (pressure, temperature, flow...)
- Identify faulty conditions.
- Analyze maintenance requirements.
- Identify hazards

  All these can be accomplished by investigating reporting

- **Hazards identification parts**
  - ✓ rotating components
  - ✓ drive chains or belts
  - ✓ hot or cold equipment parts
  - ✓ dust, vibration, noise or fumes
  - ✓ Oil spills and fuel leaks

If Employees are reluctant to report hazards in the workplace, here are some great ways to improve the quality of hazard reporting in your safety program.

a) Make reporting as easy as possible.
b) Ensure there is no negative stigma and no punishment attached to hazard reporting.
c) Give recognition to those who submit hazard reports.
d) Engage workers in the resolution of hazards to ensure the correction is satisfactory for all involved and does not create additional hardships inadvertently.
e) Keep an open discussion about safety issues, perhaps following up on the specific hazard reported at the next safety meeting.
f) Never assign blame to an individual when it comes to hazards found. Rather, attribute hazards to “systems” like insufficient budget assigned for tool replacements, lack of training, or comprehensive process needed.
g) Post signs or posters around the workplace that reinforces the message that unsafe conditions and acts must be reported.



Figure 1.5 Hazard report procedure in short way

Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test1: Choose the best answer for the following questions.

1. What could common activities or jobs be accomplished using tools and equipment? (2 points)

A. Safe work environment. B. Appropriate Work procedures

C. Specific tools and equipment for that specific job or activity. D. All

2. What could common activities or jobs be accomplished using tools and equipment? (2 points)

A. Safe work environment. B. Appropriate Work procedures

C. Specific tools and equipment for that specific job or activity. D.All

3. One is false about Production/Operations? (3 point)
   a) Production line steps
   b) Equipment maintenance, inspection procedures
   c) New employee training
   d) Performance reviews
4. What is a common understanding just before doing specific jobs? (4 points)
   a) Parameter setting (pressure, temperature, flow)
   b) Identify faulty conditions.
   c) Analyse maintenance requirements.
   d) Identify hazards.
   e) All of the above
   f) None)

Test 2: Give short answer for the following questions.

1. List at list 8 the most important job requirements types? (8 points
2. List at list 5 appropriate for inclusion in administrative SOPs
3. What it mean completing report? (5 point)
4. What it means recording information? (5point)

Operation Sheet 1

1.4 Techniques/Procedures/ checking storage temperature

A. Tools and equipment

- Thermometer
- Alcohol
- PPE

b. Procedure for Hazards identification parts of tool and equipment's

I. Rotating components
II. Identify drive chains or belts
III. Identify hot or cold equipment parts
IV. Identify dust, vibration, noise or fumes
V. Identify Oil spills and fuel leaks
VI. Reduce/eliminate hazard tool and equipment's

1.5 Report hazards and anything unusual tool and equipment's

A. Tools and equipment

- Thermometer
- Alcohol
- PPE

Procedures:

I. Set the Parameter
II. Identify faulty conditions.
III. Identify Analyze maintenance requirements.
IV. Identify hazards
V. Report hazards

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 30 minutes. The project is expected from each student to do it.

Task-1 – Identify Hazards tool and equipment's.

Task 2 -Report hazards (unusual) tool and equipment's.

LG #7	LO #2- Use hand tools

Instruction sheet

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

- Selecting appropriate hand tools
- Using hand tools with job specification
- Adhering all safety requirements
- Identifying and marking unsafe or faulty tools
- Under taking routine maintenance of tools
- Store hand tools safely in appropriate location

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:

- Select hand tools to the task requirements.
- Use Hand tools to produce desired outcomes to job specifications which may include finish, tension, size or shape.
- Adher all safety requirements are to before, during and after use.
- Identify and mark unsafe or faulty tools for repair according to designated procedures before, during and after use.
- Undertake Routine maintenance of tools, including hand sharpening according to standard operational procedures, principles and techniques.
- Store hand tools safely in appropriate location according to standard operational procedures and manufacturers' recommendations

1 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 2

2.1.Selecting appropriate hand tools

Hand tools refer to manual and electric-powered tools respectively, designed to assist construction workers, carpenters, and other manual laborers in the performance of work. Hand tools selected appropriate to the task requirements. Hand tools may include - Hacksaws, hammers, punches, screwdrivers, sockets, wrenches, scrapers, chisels, gouges, knives, Allen keys, wood planes and files of all cross-sectional shapes and types.

2.2.Using hand tools with job specification

Any hand tools have their own functions and specifications. Like specifically used for finishing processes, tensioning an equipment and, size or shape making. So any one has to understand hand tools and equipment purpose and specifications and have to be using it accordingly.

Table 2.1. Using hand tools with job specification

Utensils/Tools	**Uses/function**
Sauce pot 	- A deep dish, usually round or oval with a lid and sleeping sides made of oven safe glass or ceramic materials. Available in 11-30 quarts
Colander bowl	- used for draining liquid from food. - It consists of a bowl constructed of metal or plastic that covered with a series of holes through which the liquid can drain. - The usually has two handles and it may also contain a base or legs. - Colander is useful for draining water from boiled foods such large pasta shapes potatoes. -They are also useful for cleansing bunches of

	fruits and vegetables, allowing water to be drained as it washed over the food.
Strainer 	- A kitchen device that is used to strain liquids or to sift dry ingredients such as flour, or powdered sugar. - This utensil has a perforated or mesh bottom and is available in a variety of shapes and sizes. - Strainers are made of materials include stainless steel, tinned steel, aluminum steel and nylon
Box Grater 	- A four-sided metal box with grids of varying sizes. - Used for shredding and grating vegetables, cheese, citrus rinds and other foods.
Chopping board	- a hard surface utensils that is general made of wood laminates, Corian or plastic materials which is used as a base for cutting, slicing, chopping or mincing

	
Measuring spoon 	- are a set of spoons used to measure small amount of ingredients. - They are used to measure amount that are less than ¼ cup. –each spoon in he set measures a specific amount as indicate on its handle
Measuring cup 	- are a set of marked cups used to measure dry ingredients such as sugar and flour. - they are either made of plastic, aluminum or stainless steel - Each cup in the set measures an exact amount as indicated in cup. - there are four measuring cup in a set
UTENSILS/TOOLS	uses
Mixing Bowl 	- round bowls of varying sizes that are used for combining food and ingredients when preparing recipes - are made of plastics, ceramic, glass, copper and stainless steel range in size from 4 inches in diameter to over 16” in diameter. - common bowl sizes available include 1 ½ , 2, 2 ½, 4, 5, 6, 8, 10 and 12 quart bowl

Serving Bowl 	- is a round, open-top container used in many cultures to serve hot and cold food -made of ceramic, metal, wood, plastic, and other material - common bowl available from different sizes
Plate 	- is a broad, concave, but mainly flat vessel on which food can be served - Most plates are circular, but they have - is a broad, concave, but mainly flat vessel on which food can be served - Most plates are circular, but they have an any shape, or made of any water-resistant material.
Sterilized bottles 	- used in packaging and storing food
Jar lifter 	- Used for the canning of foods when working with glass jars to remove them from the heat.
Muslin bag/cheese clothes	- Use of cheesecloth is in some styles of cheese making, where it is used to

 	remove whey from cheese curds, and to help hold the curds together as the cheese is formed - Also used in straining stocks and custards, bundling herbs, making tofu and ghee, and thickening yogurt.

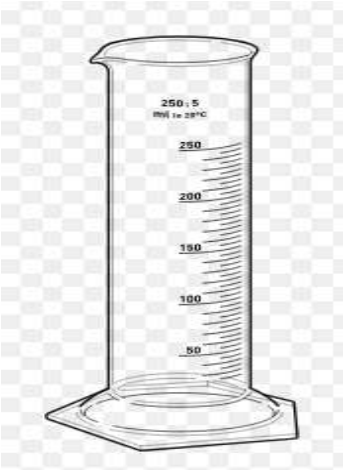
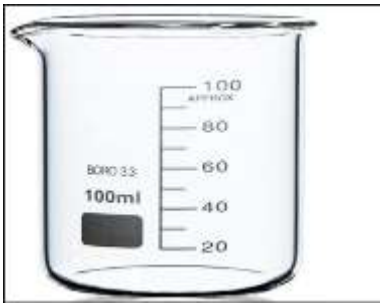
UTENSILS/TOOLS	use
Measuring glass/cup for liquid 	- A transparent with lines called marker lines, to indicate the amount of liquid. - Each marker line stands a specific amount of liquid

Equipments	USES
Load canner 	Boiling water bath canner or a large, deep saucepot with a lid, and a rack used to sterilized glass preserving jars, lids and bands when preserving high-acid foods such as jam, jelly, marmalade, fruit juices, pickles and salsas

Steamer 	- Cooking food by continuous boiling of water and the vapor that called steam will bring heat and has direct contact to the food ruling to moisture the texture.

Jar Fermenter 	-used for wine fermentation. -It has an airlock one way valve that allows gasses to escape created during fermentation to prevent the entry of oxygen, bacteria, mold spore or wild yeast from atmosphere causing the ferment to spoil.

Food thermometer 	-Is thermometer used to measure the internal temperature of meat, especially roasts and steaks, and other cooked foods

Graduated Cylinder  	- Is used for measuring volumes of liquids. This piece of equipment is used routinely, although it is only moderately accurate compared to other tools, such as volumetric flasks.
Beaker  	A beaker is a cylindrical container used to store, mix and heat liquids in laboratories.

https://www.youtube.com/watch?v=ID8ban7ktyw(access date 23/01/2023)

2.3. Adhering all safety requirements

Observing all safety requirements taking the time to inspect your tools every time you use them is one of the most important things you can do to ensure not only your safety while using them, but the longevity of your tools as well. Take the time to look for the following: Loose, cracked, or splintered The first and most important item to be consider before attempting use of hand tools, power tools &equipment's is safety, both for personnel who may be working with or near the tools that we use, as well as to prevent damage to the equipment & tools. Safety means the state of being safe, free from danger.

2.3.1 General safety rule of hand tools

Good knowledge (understanding) of tools is very important & helping you understands the various rules for safety. Any tools can cause harm if not properly used. So anyone who uses tools must use them carefully & safely to avoid injury, avoid the danger that may be caused by carelessness & ignorance.

Five basic safety rules can help prevent hazards associated with the use of hand and power tools:

- Keep all tools in good condition with regular maintenance.
- Use the right tool for the job.
- Examine each tool for damage before use and do not use damaged tools.
- Operate tools according to the manufacturers' instructions.
- Provide and use properly the right personal protective equipment's

Hand tools are tools that are powered manually. Hand tools include anything from axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance. Some examples include the following:

Some of the important safety measures to be taken are as follows.

- Handle sharp-edged tools such as pocket (electrical) knife scratch out with special care.
- When you give a sharp-edged tool to another person pass it handle first, never with the cutting edge first.

- Report all accidents immediately. Example any defective equipment & any other tools
- Keep your work area & workshop clean always.
- Handle saws of all kinds carefully, especially when starting a cut.
- Maximum accidents may happen due to operators (workers) fault. The main causes of accidents are unsafe condition, carelessness & unsafe acts.

The following list indicates the common causes of accidents.

- Improper handling & usage of hand tools& equipment.
- Failure to use protective equipment
- Failure to follow correct procedures.
- Poor handling of a workshop.
- Poor and insensible behaviour of worker.
- Faulty equipment & tools.

2.3.Identifying and marking unsafe or faulty tools

Unsafe or faulty tools are identified and marked for repair according to designated procedures before, during and after use in practice, this involves daily visual inspections aimed at detecting signs of possible fault; for example, oil or coolant leaks. This also includes the mechanical adjusting and tune-up of equipment and the detection and correction of small problems before they become major problems. Items requiring attention must be reported. Some basic rules to prevent hazards associated with the use of hand and power tools are-

- Examine each tool for damage before use.
- All damaged portable tools should remove from use and tagged “Do Not Use”.
- Keep tools sharp and clean
- Follow the instructions in the user’s manual for lubricating and changing accessories follow.
- Maintain tools according to the manufacturer’s specifications to avoid worsening vibration

2.4. Under taking routine maintenance of tools

All tools, equipment and vehicles must be properly maintained so that workers are not endangered. Constant care and adequate maintenance and storage are essential for the safe use of portable tools. Common maintenance tools and their uses tools are designed to make a job easier and enable you to work more efficiently. If they are not properly used and cared for, their advantages are lost to you. Regardless of the type of work to be done, you must have, choose, and use the correct tools in order to do your work quickly, accurately, and safely. Workers who perform routine maintenance for an apartment complex or other residential building are responsible for cleaning shared areas, inspecting and cleaning units when residents move in or out, or changing filters or other components. Criteria of maintenance:

- all relevant workplace procedures
- work instructions
- temporary instructions
- standard operating procedures
- plant description manuals
- manufacturer instructions
- specifications, service manuals
- Machine circuit diagrams for hydraulic/pneumatic and electrical/electronic circuits

2.5. Store hand tools safely in appropriate location

- To keep tools tidy, it should be cleaned after use and wiped down with a rag or towel to be sure that they are free of dirt, grease and debris.
- After cleaning, damage or defects should be checked. If the tool cannot be repaired, it should be thrown to away.
- Tools is does not directly stored on the ground both small hand and power tools should be Placed on shelving.
- Short-handled tools should be stored in a plastic bin or box. All surfaces of Power tools should be cleaned and completely dry before storage and Spraying lubricants.
- Effective machinery and equipment risk controls reflect some or all of the following characteristics.
- Fail-safe (failure of the control system to be effective will result in machinery shut-down)
- Tamper-proof design (as difficult as possible to bypass)
- presents minimum impediment to machinery and equipment operator
- Easy to inspect and maintain
- does not introduce further hazards through the risk control action.

Self-Check –2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test -1: Choose the best answer the following questions.

1. Used in packaging and storing food?
   a) Hydrometer b. Beaker. C. Sterilized bottles d. Jar Fermenter
2. Which one of the following are hand tools?
   a, Hacksaws, b) knives c) hammers d) all)
3. Which one of the following is common cause of accidents?
   a. Improper handling & usage of hand tools& equipment.
   b. Failure to use protective equipment
   c. Failure to follow correct procedures.
   d. Poor handling of a workshop
   e. All of the above
4. Which one of the following are basic safety rules can help prevent hazards associated with the use of hand and power tools?
   a. Keep all tools in good condition with regular maintenance.
   b. Use the right tool for the job.
   c. Examine each tool for damage before use and do not use damaged tools.
   d. Operate tools according to the manufacturers' instructions
   e. All of the above
5. What are basic rules to prevent hazards associated with the use of hand and power tool? (4 points)
   a. Examine each tool for damage before use.
   b. All damaged portable tools should remove from use and tagged "Do Not Use".
   c. Keep tools sharp and clean
   d. Follow the instructions in the user's manual for lubricating and changing accessories follow.

e. All of the above

6. One of the following is types of maintenance?
   a. Operational maintenance
   b. Removal and replacement
   c. General cleaning
   d. All of the above
   e. None of the above
7. All are operations maintenance procedures but note include?
   a. all relevant workplace procedures
   b. work instructions
   c. temporary instructions
   d. standard operating procedures
   e. All of the above
   f. None of the above

Test 2: Give short answer

1. List at list five basic safety rules can help prevent hazards use of hand and power tools?
2. List at list 5 using hand tools and specification?

Operation Sheet 2

2.6. **Preparing and Storing Tools and equipment's**

A, Tools and equipment

- Glove
- Mask
- Goggles
- Apron/gown

B, Procedure of Preparing and Storing Tools and equipment's

I. Clean the tools after use and wipe down with a rag or towel.
II. Check the damage or defects after cleaning.
III. Throw away the not repaired tools.
IV. Scrape away any soil or dirt from the metal surfaces.
V. Dry the tool before placing in the storage.
VI. coat the metal parts of the tools with a lubricant protector spray
VII. Store the tools on shelving. Not directly on the ground
VIII. Store Short-handled tools in a plastic bin or box.
IX. clean and completely dry all surfaces of Power tools before storage and Spraying lubricants

LAP TEST-2	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 60 minutes. The project is expected from each student to do it.

Task-1: Perform store Tools and equipment's.

LG #8	LO #3- Use power tools

Instruction sheet

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

- Selecting appropriate power tools
- Using power tools for clamping, alignment and adjustment
- Adhering all safety requirements
- Identifying and marking unsafe or faulty tools
- Undertaking operational maintenance of tools
- Storing power tools safely in appropriate location

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:

- Select appropriate Power tools to the task requirements.
- Use Power tools for a determined sequence of operations - which may include clamping, alignment and adjustment to produce desired outcomes -to job specifications which may include finish, size or shape.
- Adhered all safety requirements are to before, during and after use.
- Identify and mark Unsafe or faulty tools for repair before, during and after use according to designated procedures.
- Undertaken operational maintenance of tools, including hand sharpening according to standard workplace procedures, principles and techniques.

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 3

3.1. **Selecting appropriate power tools**

Electric or pneumatic/hydraulic drills: Pneumatic systems work on the power of compressed air. With the help of modern technology, they have dramatically increased their drilling capabilities. Pneumatic systems are the solution to add production to a developed quarry. A pneumatic system is ideal when your production requirements are on the low to medium side (roughly under 650 feet per day of drilling).

Grinders: An angle grinder is a handheld power tool that can be used for a variety of metal fabrication jobs that include cutting, grinding, deburring, finishing and polishing. The most common types of angle grinder tools are powered by electricity; either corded or battery powered.

Jigsaw: It is a saw which uses a reciprocating blade to cut irregular curves, such as stencilled designs, in wood, metal, or other materials. Jigsaw power tool is made up of an electric motor and a reciprocating saw blade. Jigsaw is a machine saw with a fine blade enabling it to cut curved lines in a sheet of wood, metal, or plastic. A jigsaw is a saw which uses a reciprocating blade to cut irregular curves, such as stenciled designs, in wood, metal, or other materials.

Nibblers: The Gericke nibbler de-agglomerates blocks of dried fruit used in products such as breakfast cereals and infant food. It includes an all-welded shaft assembly, 240 grit/0.6 RA finish internally and a woven-wire, a 316 stainless steel screen with a 20- to 30-mm opening. Low-speed, high-torque rotation breaks up agglomerates without smashing them.

Cutting saws: The automatic saw RB-1 has been designed to work automatically and with precision cutting accurately the predetermined measurements of any frozen or fresh product either meat, fish, or vegetables.

3.2.Using power tools for clamping, alignment and adjustment

Clamping as the fixing of a tool with which a workpiece can then be machined.Power tools are used for a determined sequence of operations which may include clamping, alignment and adjustment to produce desired outcomes to job specifications which may include finish, size or shape. All safety requirements are adhered to before; during and after use any hand tools have their own functions and specifications. Like specifically used for finishing processes, tensioning an equipment and, size or shape making. So any one has to understand hand tools and equipment purpose and specifications and have to be using it accordingly

3.2.1 Laboratory apparatus

3.2.1.1 Calibrate Refractometer

Refract meter for fast and accurate determination of total soluble solid. Procedure on How to Use and Calibrate the Refract meter. Once the refract meter has been properly calibrated, you are ready to take readings of juice or whatever else you want to sample. Begin the calibration of your refract meter by lifting up the daylight plate and placing 2-3 drops of distilled water on top of the prism Assembly.

I. Close the daylight plate so the water spreads across the entire surface of the prism without any air Bubbles or dry spots.
II. Allow the test sample to sit on the prism for approximately 30 seconds before you attempt calibration in the next step.
III. Hold the refract meter in the direction of natural light source and look into the eyepiece. You will see a circular field with graduations down the center. You may have to focus the eyepiece to clearly see the graduations
IV. Turn the calibration screw until the boundary between the upper blue field and the lower white meet exactly at zero on the scale.
V. Clean a refractometer



Figure 3.1 Refractometer

https://www.youtube.com/watch? K6GR343eycE(access date 24/01/2023).

3.2.1.2 PH meter

PH meter- electric device used to measure hydrogen-ion activity (acidity or alkalinity) in solution. A pH meter is an analytical instrument that measures the activity or basicity of a solution, a key parameter for many applications in various industries measuring the pH of fruits and vegetables and similar solid samples is a major challenge. Forced penetration into the sample using a conventional sensor, can result in scratches occurring on the sensor membrane and under extreme cases, may result in irreparable damage to the sensor. In addition, the presence of a ceramic junction increases the chances of junction clogging due to the entry of particulate matter. This would also result in minimum or no interaction between the sample and the reference electrolyte. Leading to inconsistency in readings along with a reduced lifetime of the sensor. Therefore, a specialized sensor is a must for pH measurements of fruits and vegetable. The following section covers some more information about the pH levels of fruits and vegetables and the importance of pH measurement.

Where is the pH of fruits and vegetables measured?

The pH measurement of fruits and vegetables is used by various processing and canning industries. The analysis includes pH determination in a whole, fresh cut, frozen, or canned fruit or vegetable.

Why is measuring the pH of fruits and vegetables important?

The freshness of fruits and vegetables indicates their maximum nutritional benefit. The pH levels help confirm the shelf life and freshness of these products. Based on the above information, i.e. the amount of acid present in the fruits and vegetables, suitable preservation techniques are carried out. To learn more details about samples, choosing the right sensor and adopting good measuring practices, download the application note by clicking the button above for the pH measurement of fruits and vegetables.



Figure 3.2 .PH meter

a) Procedure in Calibration For pH meter

I. Turn on your pH meter. Before you begin to calibrate and use your pH meter you will first need to turn it on and allow adequate time for the meter to warm up. This should generally take around 30 minutes, but check your pH meter's operating manual for exact times.

II. Clean your electrode. Take the electrode out of its storage solution and rinse it with distilled water under an empty waste beaker. Once rinsed, blot dry with Kim wipes or wipes, which are available at most office supply stores. Be sure to rinse your electrode in a waste beaker that is different from the beaker you will be calibrating in.

III. Avoid rubbing the electrode as it has a sensitive membrane around it.

IV. If you find the electrode to be particularly dirty, consult your operating manual for recommended cleaning solutions.

b) Prepare your buffers

Prepare your buffers you will generally need more than one buffer for calibrating a pH meter. The first will be a "neutral" buffer with a pH of 7, and the ear the expected sample pH, either a pH of 4 or 9.21. Buffers with a higher pH (9.21) are best for measuring bases, whereas buffers with a low pH (4) are best for measuring acidic samples. Once you have chosen your buffers allow them to reach the same temperature as the pH meter because pH readings are temperature dependent. Pour your buffers into individual beakers for calibration Check with your pH meter manufacturer, or current educational or professional institution, about acquiring pH buffer solutions. Buffers should be kept in a beaker for no longer than two hours. Discard the buffer when you are finished. Do not return it to its original contained.

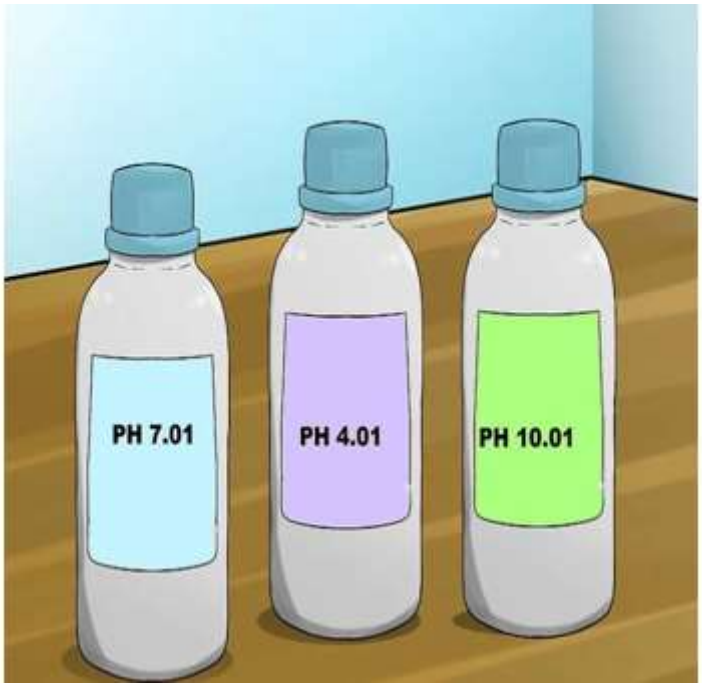


Figure-3.3. Buffer solution

PH meter calibration

Place your electrode in the buffer with a pH value of 7 and begin reading. Press the "measure" or calibrate button to begin reading the pH once your electrode is placed in the buffer. Allow the pH reading to stabilize before letting it sit for approximately 1-2 minutes.

I. Set the ph.

Once you have a stable reading, set the pH meter to the value of the buffer's pH by pressing the measure button a second time. Setting the pH meter once the reading has stabilized will allow for more accurate and tuned readings. Although not necessary, if you stir your buffer before measuring be sure to stir all other buffers and samples in the same way Rinse your electrode with distilled water. Rinse and pat dry with a lint-free tissue,

like Kim wipes or Swipes, in between buffers. Place your electrode in the appropriate buffer for your sample and begin reading. Press the measure button to begin reading the pH once your electrode is placed in the buffer.

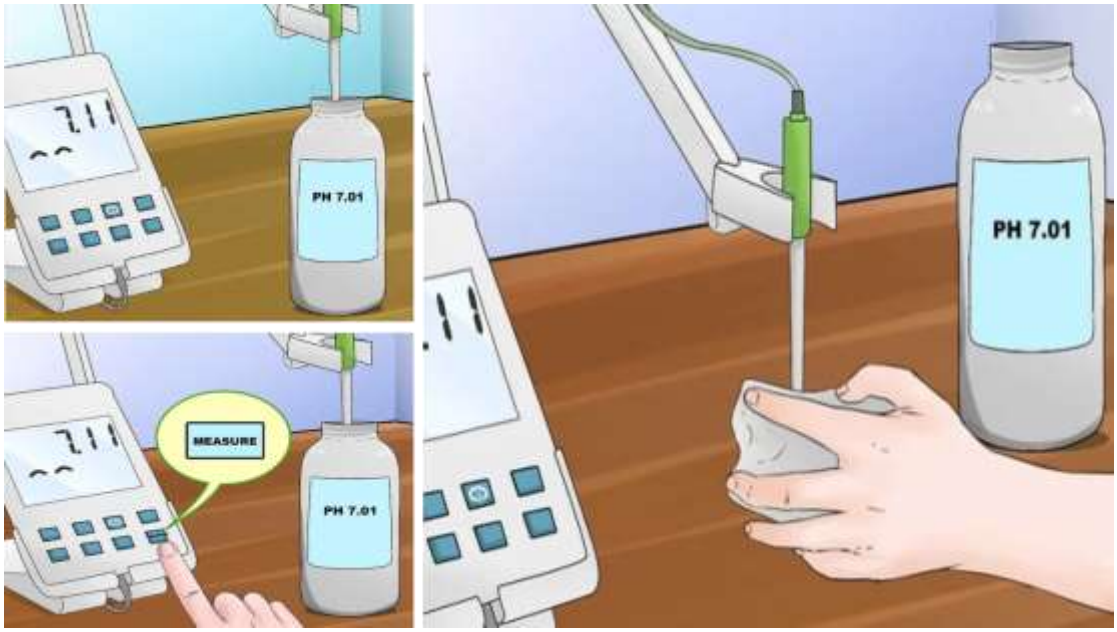


Figure 3.4.Calibrate to buffer pH 7

- **Set the pH a second time**

Set the pH a second time once your reading has stabilized, set the pH meter to the value of the buffer's pH by pressing the measure button.

- **Rinse your electrode**

Rinse your electrode you can use distilled water to rinse. Use a lint-free tissue, like Kimb wipes or Swipes, in between buffers to dry the electrode

- **Top loading Balance**

Top loading Balance a top loading balance (also referred to as top loader balance) is among the most common types of weight measuring scales used in the laboratory.

How to use the top loading balance

I. Place the electronic balance on a flat, stable surface indoors. The precision of the balance relies on minute factors and wind, shaky surfaces, or similar forces will cause the readings to be inaccurate.

II. Press the "ON" button and wait for the balance to show zeroes on the digital screen. Use tongs or gloves to place the empty container you will use for the substance to be measured on the balance platform. Fingerprints and other greases from your hands add mass and must be avoided for accurate measurements.

III. Press the "Tare" or "Zero" button to automatically deduct the weight of the container from future calculations. The digital display will show zero again, indicating that the container's mass is stored in the balance's memory.

IV. Carefully add the substance to the container. Ideally, this is done with the container still on the platform, but it may be removed if necessary. Avoid placing the container on surfaces that may have substances, which will add mass to the container such as powders or grease.

V. Place the container with the substance back on the balance platform if necessary and record the mass as indicated by the digital display



Figure 3.5 Sensitive Balance

Table 3.1 power tools

Name of tools	Purpose
 **Pressure Cooker**	- It cooks food faster and tenderize certain food, which is tough like meat and beans quickly. The high pressure helps force liquid and moisture into the food quickly
Steamer 	- Cooking food by continuous boiling of water and the vapor that called steam will bring heat and has direct contact to the food resulting to moisture the texture.
	It can measure the temperature of a solid such as food, a liquid such as water, or a gas such as air. The three most common units of measurement for temperature are Celsius, Fahrenheit, and kelvin. The Celsius scale is part of the metric.

Juice Extractor 	- Use to extract juices from fruits and vegetables.
	The purpose of the desiccator is to either dry a chemical or keep a chemical from becoming “wet” from atmospheric humidity (water in the air). Common desiccants are CaSO4 (Drierite), silica gel, MgSO4, and P2O5. Drierite is used quite frequently because it changes from blue to pink as it absorbs water.

3.3.**Adhering all safety requirements**

Power tools must be fitted with guards and safety switches; they are extremely hazardous when used improperly. The types of power tools determined by their power source: electric, pneumatic, liquid fuel, hydraulic, and powder-actuated. To prevent hazards associated with the use of power tools, workers should observe the following general precautions

- Keep cords and hoses away from heat, oil, and sharp edges.
- Disconnect tools when not using them, before servicing and cleaning them, and when changing accessories such as blades, bits, and cutters.
- Keep all people not involved with the work at a safe distance from the work area.
- Avoid accidental starting.
- Do not hold fingers on the switch button while carrying a plugged-in tool.
- Maintain tools with care; keep them sharp and clean for best performance.
- Follow instructions in the user is manual for lubricating and changing accessories.
- Be sure to keep good footing and maintain good balance when operating power tools.
- Wear proper apparel for the task. Loose clothing, ties, or jewellery may become caught in moving parts.
- remove all damaged portable electric tools from use and tag them: “do not use

The exposed moving parts of power tools need to be safeguarded Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded Machine guards, as appropriate, must be provided to protect the operator and others from the following:

- Point of operation
- Rotating parts
- Flying chips and sparks.

Never remove safety guards when a tool being use

Employees using electric tools must be aware of several dangers. Among the most serious hazards are electrical burns and shocks. Electrical shocks, which can lead to injuries such as heart failure and burns, are among the major hazards associated with electric powered tools. Under certain conditions, even a small amount of electric current can result in fibrillation of the heart and death. An electric shock also can cause the user to fall off a ladder or other elevated work surface and be injured due to the fall. The following general practices should be followed when using electric tools:

- Operate electric tools within their design limitations.
- Use gloves and appropriate safety footwear when using electric tools.
- Store electric tools in a dry place when not in use.
- Do not use electric tools in damp or wet locations unless they are approved for that purpose.
- Keep work areas well lighted when operating electric tools.
- Ensure that cords from electric tools do not present a tripping hazard.

3.4.**Identifying and marking unsafe or faulty tools**

In practice, this involves daily visual inspections aimed at detecting signs of possible fault; for example, oil or coolant leaks. This also includes the mechanical adjusting and tune-up of equipment and the detection and correction of small problems before they become major problems. Items requiring attention should be reported. Removing unsafe tools from use and immediately notifying supervisor**.**

- **Some basic rules to prevent hazards associated with the use of hand and power tools are:-**
  - ✓ Examine each tool for damage before use.
  - ✓ All portable tools that damaged should be removed from use and tagged “Do Not Use”.
  - ✓ Keep tools sharp and clean
  - ✓ Follow the instructions in the user’s manual for lubricating and changing accessories follow.
  - ✓ Maintain tools according to the manufacturer’s specifications to avoid worsening vibration.
  - ✓ Store hand tools and utensils in proper area
  - ✓ Store hand tools and utensils in proper area.
  - ✓ Clean after use
  - ✓ Report unusable tools to supervisor

3.5.**Undertaking operational maintenance of tools**

Maintenance can be defined as working on something to keep it in a functioning and safe state and preserving it from failure or decline. May include but not limited to: Hand sharpening, cleaning, lubricating, and tightening Simple tool repairs and adjustments using engineering principles, tools, equipment and procedures to statutory and regulatory requirements. Basically there are two types of maintenance:-

a) **Preventive or proactive maintenance:** carried out to keep something functional. This type of activity usually planned and scheduled.
b) **Corrective or reactive maintenance:** is repairing something to get it working again. This is an unscheduled, unplanned task, usually associated with greater hazards and higher risk levels. Factors to consider when making the maintenance plan:
    - Type of tool and power source
    - Manufacturer's instructions and recommendations.
    - Age of the tool.
    - Frequency of use and the work cycle of the tool.
    - Working environment in which the tool is used (e.g. wet or dusty), or likelihood of mechanical damage.
    - Foreseeable misuse of the tool
    - Effects of any modifications or repairs to the tool
    - Analysis of previous records of maintenance.

Do maintenance safely

- Always disconnect powered tools before servicing, adjusting, oiling, cleaning or repairing them, sharpening or changing accessories such as blades.
- Follow the manufacturer's instructions in user's manual for maintenance and servicing (e.g. lubrication, cleaning) and changing parts and accessories.
- Use appropriate tools and equipment while carrying out maintenance
- Do not modify or alter tools.
- Never remove guards.
- Do not tie them back or modify them.

- Don’t modify safety features built into switches
- When maintenance is, complete workers have to check if the maintenance has left the portable tools in a safe and functioning condition:
- Test the functionality of the tool
- Replace all guards and safety devices
- Record your inspection and actions, sign out and pass the tool to the worker or store it safely.

3.6.**Storing power tools safely in appropriate location**

It is important that the tools used around food processing maintain their hygienic qualities. Leaving food contact tools unorganized and in unsanitary locations when not in use is not advised. Proper storage in a clean, protected storage area ensures good hygiene and helps extend tool life. Extreme temperatures and/or humidity levels can affect the life and lasting quality of the food contact tools and equipment. Extremely cold temperatures or long exposure to very cold temperatures can cause fracturing of tools and possible physical hazards in a food facility. High-humidity areas that do not allow for proper tool drying can support the growth of microbial hazards. There should be sufficient storage location and procedures for a range of power tools in a work place.

https://www.youtube.com/watch?v=ICpIBtDAwrI(access date 24/01/2023))

Self-Check – 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test1: Choose the best answer for the following questions.

1. Which One of the following are factors affecting a pan's ability to cook evenly?

A. Thickness of the metal B. Kind of metal C. A and B D. None

2. _____is used for fast and accurate determination of total soluble solid?

a, PH Meter. b. Refract meter. C. loading balance. d. All e. None

3. _____is Cooking food by continuous boiling of water and the vapor that called steam will bring heat and has direct contact to the food resulting to moisture the texture? point)

A. Steamer B. Pressure Cooker. C. Juice Extractor D. all F. None of the above

4. Which one of the following are general practices should be followed when using electric tools?
   a) Operate electric tools within their design limitations.
   b) Use gloves and appropriate safety footwear when using electric tools.
   c) Store electric tools in a dry place when not in use.
   d) Do not use electric tools in damp or wet locations unless they are approved for that purpose.
   e) Keep work areas well lighted when operating electric tools.
   f) All of the above

5. Which of the following actors to consider when making the maintenance plan except one?
   a. Type of tool and power source
   b. Manufacturer's instructions and recommendations
   c. Age of the tool.
   d. Analysis of previous records of maintenance
   e. All of the above.
   f. None of the above

6. One of the following are can affect the life and lasting quality of the food contact tools and equipment?
   a. Extreme temperature b. humidity c. a and b d. all e. none

Test 2 : Give short answer for the following questions.

1. List at list 4(four) materials are used for cooking equipment?
2. Write different between PH Meter, Refract meter and loading balance?
3. Write Never remove safety guards when a tool being use?
4. Write at list 4 (four Rules to Observe in the Use and Care of power Tools and Utensils?
5. Write basically two types of maintenance?

Operation Sheet 3

3.2 Calibrating the Refract meter

A, Tools and equipment

- Glove
- Mask
- Goggles
- Apron/gown

B, Procedure of Calibrating the Refract meter

I. Lift up the daylight plate of Refract meter
II. Place 2-3 drops of distilled water on top Refract meter.
III. Close the daylight plate water spreads across the entire surface
IV. Allow the test sample to sit for approximately 30 seconds.
V. Look into natural light source eyepiece.
VI. Focus the eyepiece to clearly see the graduations.
VII. Read the correct Calibration numbers (23 %) moistures and 60-65% sucrose's

.

LAP TEST3	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 40 hour. The project is expected from each student to do it.

Task 1 - Calibrating the Refract meter

LG #9	LO #4- Monitor and use the equipment/ process

Instruction sheet

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

- Turning on and off equipment required packed plant
- Monitoring equipment throughout the job.
- Recognizing deviation of variables from standard/desired conditions.
- Taking appropriate corrective action

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:

- Turn on and off the equipment as required by the packaged plant procedure.
- Monitor equipment throughout the job using measurements, readings and senses as appropriate.
- Recognize deviations of Variable from standard/desired conditions.
- Taken Appropriate corrective action

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 4

4.1.Turning on and off equipment required packed plant

According to manufactures or operational procedures and specification, workers should apply:

- Make sure power tools are properly grounded or are double insulated
- Switch off and unplug power tools before changing blades or servicing and repairing
- Wear appropriate personal protective equipment (PPE), such as glasses, goggles, dust masks, face shields, hearing protection, etc.
- Keep bystanders at a safe distance
- Keep all guards and shields in place
- Unplug and store tools after use
- Consider keeping power tools locked up to prevent unauthorized use
- Cleaning and other activities by turning off the equipment by unplugging a power or by pressing emergency button. In addition, after any cleaning and maintenance activity, equipment has to be put on and checked its functionality and if any deviations against SOPs.

4.2.**Monitoring equipment throughout the job.**

Workers have to monitor the equipment's operation correctly and report tools/equipment malfunctions or problems according to procedures to his immediate supervisors. A finished product may exhibit several quality characteristics. Quality control (QC) techniques apply by inspecting and measuring the product quality characteristics using inspection equipment and some procedures. By comparing to the standard, the product can be identified whether conforms to requirements or fails, consider as accepted or rejected as well. Inspection provides useful information about the current demonstrated product quality. Temperature is the most important ambient parameter in the context of quality retention and shelf life because it strongly influences all spoilage mechanisms of fresh fruit.

In manufacturing, machine monitoring is the method of using sensors to collect data from key pieces of equipment in your manufacturing process. In any given process, the most important manufacturing equipment to monitor is the constraint. Performance monitoring (e.g., speed, uptime/downtime, planned/unplanned stops). Resource consumption monitoring (e.g., electricity, water, coolants). Equipment condition and surrounding environment monitoring (e.g., temperature, humidity) using noise, vibration, temperature, pressure, and other sensors.

https://www.youtube.com/watch?v=BVO0m3A4tz4date 25/01/2023).

4.3.Recognizing deviation of variables from standard/desired conditions.

Recognizing deviations of variables

Recognizing Variables to be monitored include:

- Equipment performance (e.g. speed, output, variations)
- equipment component performance
- sequences and timing of operation
- materials changes (desired and not desired

Recognizing Deviations to be included:

- equipment production outputs
- equipment operating conditions
- Operating parameters like temperatures and pressures.so all these expected deviations has to be recognized monitored and reported.

4.4.**Taking appropriate corrective action**

There may be any operational parameter deviations and or malfunctioning on equipment during operating .and, it has maintained accordingly by an expert based on manufacturer's recommendations taking appropriate corrective action includes:

- Instruction for the safe use, handling and storage of the product.
- The personal protective equipment or safety devices required.
- The steps for cleaning up spills.
- Information on the waste disposal requirements.
- **Corrective Action include :**
  - ✓ Installing alarms.
  - ✓ Redesigning or replacing equipment.
  - ✓ Recalibrating tools.
  - ✓ Updating work processes.
  - ✓ Retraining employees on policies and procedures.

https://www.youtube.com/watch?v=oOpxbkM8HNA (access date 23/01/2023).

Self-Check – 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test1: Choose the best answer for the following questions.

1. According to manufactures or operational procedures and specification, workers should apply before shouting down /or on machine? (4point)
    a. Make sure power tools are properly grounded or are double insulated
    b. Switch off and unplug power tools before changing blades or servicing and repairing
    c. Wear appropriate personal protective equipment (PPE)
    d. All of the above
2. _____are variables to be monitored may include except ones? (4point)
    a. Equipment performance (e.g. speed, output, variations)
    b. equipment component performance
    c. sequences and timing of operation
    d. materials changes (desired and not desired
    e. None of the above.
3. One of the following is Monitoring equipment throughout the job? (4point)
    a. Physical measurements
    b. Visual inspection
    c. Chemical tests
    d. all e. none
4. Which one of the following are preventive measures except one? (4point)
    a. Instruction for the safe use, handling and storage of the product.
    b. The personal protective equipment or safety devices required.
    c. The steps for cleaning up spills.

d. Information on the waste disposal requirements

e. none of the above

Reference Materials

Books:

Brackett, R.E. 1992. Shelf stability and safety of fresh produce as influenced by sanitation and inspection. Journal ofFood Protection 55:808-814

Brackett, R.E. 1993 Microbial quailty In R L. Shewfelt and SE. Prussia (eds) Postharvest Handling: A s.vstems Approach New York: AcademiC Press

IntematlOnal Fresh-cut Produce AssocwtlOll Food Sa/ GllIdelinesfor the Fresh-cuI Produce Industl), (3rd EditIOn) Alexandria, VA IFPA

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Web Address

https://www.wikihow.com/Calibrate-and-Use-a-pH-Meter#/Image:Calibrate-and-Use-a-pH-Meter-Step-9-Version-2.jpg (access date18/01/2023).

https://www.youtube.com/watch? K6GR343eycE(access date 24/01/2023).

https://www.youtube.com/watch?v=BVO0m3A4tz4 (access date 25/01/2023).

https://www.youtube.com/watch?v=ID8ban7ktyw(access date 21/01/2023)

https://sciencing.com/use-electronic-balance-.htmlhttps://blog.beamex.com/weighing-scale-calibration-how-to-calibrate-weighing instruments (access date 20/01/2023

https://bitesizebio.com/24193/how-to-clean-and-maintain-scales/

https://www.wikihow.com/Calibrate-and-Use-a-pH-Meter#/Image:Calibrate-and-Use-a-pH-Meter-Step-9-Version-2.jpg (access date 23/01/2023)

https://sciencing.com/use-electronic-balance(access date 20/01/2023)

.htmlhttps://blog.beamex.com/weighing-scale-calibration-how-to-calibrate-weighing-instruments access date 19/01/2023).

https://bitesizebio.com/24193/how-to-clean-and-maintain-scales/ (access date 21/01/2023).

https://www.youtube.com/watch?v=oOpxbkM8HNA (access date 23/01/2023).

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