Fruit and Vegetable processing

Level-I





Based on November 2021,Version-3 Occupational Standard

Module Title: Performing Cooling and Wrapping Operation

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Introduction to the Module

This module aims to provide the trainees with the knowledge, skills and attitudes required to set up, operate, adjust and shut down a cooling, slicing and wrapping process. The module has four learning outcome such as prepare the cooling and wrapping equipment and process for operation, operate and monitor the cooling and wrapping process, monitor and inspect closure and seams and shut down the cooling and wrapping process.

Fruits and vegetables provide an abundant and inexpressive source of energy, bodybuilding nutrients, vitamins and minerals. Their nutritional value is highest when they are fresh, but it is not always possible to consume them immediately. During the harvest season, fresh produce is available in abundance, but at other times, it is scarce. Moreover, most fruits and vegetables are only edible for a very short time, unless they are prompt and properly preserved. For this reason cooling and wrapping module Will help you to preserve friut and Vegetables as soon as possible after harvested.

LG #19 LO#1-Prepare the Cooling and Wrapping Equipment and Process for Operation

Instruction sheet

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

- Confirming available Product and packaging consumables.
- Identifying and confirming cleaning and maintenance requirements
- Fitting and adjusting machine components and related attachments.
- Entering Processing/operating parameters within production requirements.
- Checking and adjusting equipment performance.
- Carrying out Pre-start checks

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

- Confirm product and packaging consumables available to meet operating requirements.
- Identify and confirm cleaning and maintenance requirements and status.
- Fit and adjust machine components and related attachments to meet operating requirements.
- Enter processing/operating parameters as required to meet safety and production requirements.
- Check and adjust equipment performance as required.
- Carried out pre-start checks as required by workplace requirement

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

1.1 **Confirming available Product and packaging consumables**.

1.1.1 Definition of terms

Packaging is an essential part of processing and distributing foods. Food packaging is vital for protecting food against external microbes and bacteria.

1.1.2 Confirming available Product

Fresh fruits and vegetables produce respires even after harvesting. At the time of harvest, the temperature of the product usually is near or slightly above the ambient temperature in the field. Once the product is detached from the plant, water movement from the plant through the fruit or vegetable ceases and heat energy begins to accumulate as a result of exposure to the sun as well as from the heat of respiration in the living tissues. The rate of deterioration of products is directly proportional to the high respiration rate. Maturation is undesirable in vegetables, easily damaged mechanically and by heat and cold.During respiration process, oxygen is used and CO2 is released.Fruits classified as climacteric and non-climacteric. Climacteric those that can ripen after being picked such as Apricot, Apple, Avocado, Mango, Banana, Guava, Jackfruit, Muskmelon, Papaya, Pear, Plum, Peach, Tomato and Kiwi fruit**.** Non-climacteric is simply does not ripen after the product has been harvested like Raspberry, Pomegranate Blackberry Peas, Pepper, Pineapple, Cherry, Cucumber, Date, Okra and Orange.

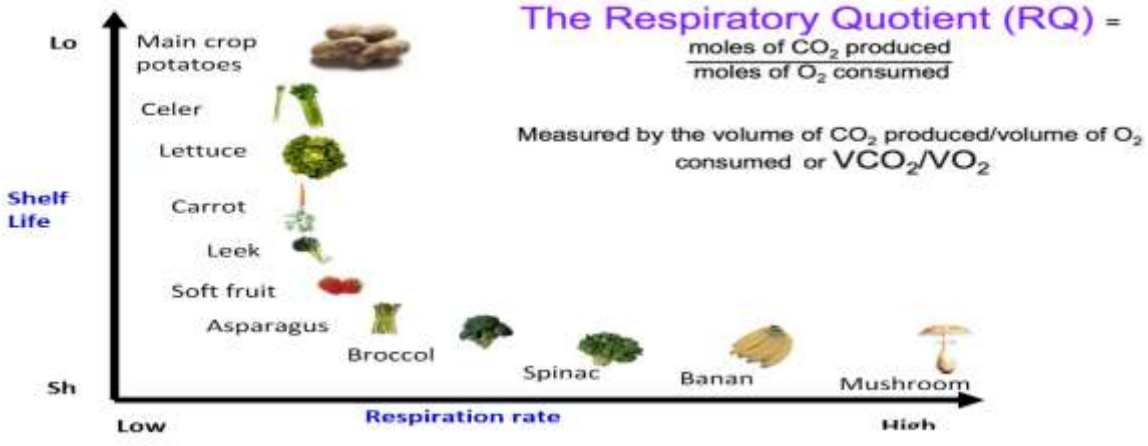


Figure 1.1 Respiration of fruits and vegetables

Most fruits and vegetables are damaged by temperature as high as 38°C and higher.The characteristics of Fruits and vegetables are high moisture content (85-90%), high perishability due to over-ripening, maturing, shrivelling, microbial rot.The receiving point for fresh fruits and vegetables in a fresh-cut processing plant is a key quality check-point that should be monitored closely. Fresh Fruits and Vegetables quality assessments at reception area check the following characters.

- Fully ripe and quality fruits. Fruits have their optimum ripening temperature. E.g. tomatoes best ripen at 20-25°C, bananas 15-22°C.
- Should be stored at cool place and free from dirt, mechanical injury and insect damage.
- Immediately after harvesting should be cooled for example cooled to 7^{o}C.
- Fresh appearance;
- No decay; no contamination; defects; and
- No discoloration;
- Crisp texture;
- Good aroma and flavour.
- Variety
- Density
- Total acidity
- Total sugars

1.1.3 Packaging Materials and packaging methods

Horticultural products are very easily affected by climatic conditions, distribution hazards and microbial decay due to highly perishable in nature. In order to develop a suitable package for horticultural produce, it is important to understand the biology of the produce. While developing a packaging system, following product characteristics have to be considered.Packaging fresh fruits and vegetables is one of the more important steps in the long and complicated journey from grower to consumer. Bags, crates, hampers, baskets, cartons, bulk bins, and palletized containers are convenient containers for handling, transporting, and marketing fresh produce.

1.1.3.1 Types of packaging materials

The choice of the proper packaging material will be made by the food processor based on the requirements:

- Composition of the food (solid or liquid),
- Physical, chemical, and microbiological and deteriorative reactions that might occur,
- Socio-economic situation of the expected customer or market,
- Cost of the packaging material, etc.

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

Table 1. 1 Reasons for selection and rejection of specific packaging material

Types of Packaging Materials			
Paperboard	**Glass**	**Metal/Steel**	**Plastics**
Selection			
Easily machined and folded	Product visibility	Strong, stiff	Fabric ability
Easy to bond	Impervious, inert	Malleable /softness	Variety of forms
Composites well	Image of high quality	Retortable	Tough/strong, light weight
Rejection			
Water absorption possibility	Shatters	Corrodes	Thermal limit
Penetrable	High weight-to strength ratio	Limits shapes	Permeable/water absorption
Image	Limited shapes	Appearance	Absorbs flavors
Punctures	Large sizes	Flavor, distortion	Distortion and leaving shape

A. **Glass Containers**

Glass makes impermeable containers that are easy to open and reclose. It is inert and thus it is safe to store food and drinks. Glass is 100% recyclable and can be recycled endlessly with no loss in

quality or purity. Glass recycling is a closed loop system, creating no additional waste or by-products. In most countries, bottles and other glass containers are either returned to be refilled or are recycled at a high rate. Glass is one of the most important packaging materials to pack powder milk and pasteurized milk because of its high barrier and see-through properties.

Advantage of Glass Containers

- They are resistant to moisture, gases, odors, and microorganisms.
- They are inert and do not react with or migrate into food products.
- They are transparent and display the contents.
- They are perceived by the customer to add value to the product.

Disadvantages of glass containers

- Higher weight and he hence higher transportation costs than other types.
- Lower resistance than other materials to cracks, scratches, and thermal shock.
- Potentially serious hazards arise from glass fragments in foods.



Figure 1.2. glass container

1.1.3.2 **Requirements for effective food packaging**

- not contain any types of toxic chemical
- should permit rapid cooling of the products
- should be stable to high humidity and moisture

- must encounter handling and marketing requirement in term of size, Shape, strength and weight in accordance with international standards
- must have the appropriate mechanical strength to protect the products
- should be inter-lockable and stackable
- should be cost effective
- should be easily open
- should be of suitable standard depending on the market demand
- should be compatible with food
- Recyclability/biodegradability- most produce packaging are going to be recyclable or biodegradable, or both.
- Protect against contamination from microorganisms,
- Act as a barrier to moisture loss or gains and oxygen ingress
- Protect against ingress of odors or environmental toxicants
- Filter out harmful UV light
- Provide resistance to physical damage
- be transparent

1.1.4. Special Packaging systems

I. Modified Atmospheric Packaging(MAP) for Fruits and Vegetables

It is enclosure of food in a package in which the atmosphere (gaseous composition) surrounding the food is modified or altered to give optimum atmosphere for extension of shelf life (by 40-50%) and maintaining quality of food. MAP is normally used in combination with low temperature. Shelf life can be increased and quality of fruits and vegetables can be maintained by controlling the metabolic process by maintaining O2 and CO2 (and other gases) concentrations at proper levels.



Figure 1.3. Modified atmosphere packaging

https://www.youtube.com/watch?CquXUa7ZPjA(access date 17/01/2023)

II. Controlled Atmosphere packaging(CAP)

In CAP, the atmosphere inside the package is continuously monitored and adjusted to maintain the optimum composition within quite close tolerances (so called controlled atmosphere). In strict sense, CAP is enclosure of food in a gas impermeable package, the gaseous composition inside which with respect to CO2, O2, N2, water vapor etc has been changed to increase the shelf life of food. The normal composition of air is 78% Nitrogen, 21% Oxygen, 0.03% Carbon dioxide and trees of the noble gases. With tomatoes, excessively low O2 or high CO2 prevents proper ripening even after removal of the fruit to air, and CA enhances the danger of chilling injury.

- Normally bulk packaging and storage
- Normally fruits and vegetables, and fresh produce.



Figure 1.4. MAP

III. Vacuum packaging

Sometimes considered as active MAP method. Package, normally retail package, evacuated mechanically (vacuum pump), and the food is held in air free atmosphere.

- package is skin-tight
- longer shelf life in oxygen free system
- Normally applied to meat, fish, poultry, cheese
- Suitable packaging materials: PVDC, EVOH (v. low GTR). Nylon may be used in laminate.



Figure 1.5 Vacuum packaging

https://www.youtube.com/watch?v=JzcGx6dXB9Q

1.1.5 Levels of packaging

a) Primary Packaging

The packaging that most closely touches a product, often referred to as “retail packaging. Its main goals are to protect the product and inform or attract a customer.



Figure 1.6. Primary Packaging

b) Secondary Packing

- The packaging used to ship products already in primary packaging.
- Its main goals are to protect products and provide branding during shipping.
- It's also used as display packaging in retail locations such as grocery stores.
- Secondary packaging can overlap with tertiary packaging as well.

c) Tertiary Packaging

- The packaging used most often by warehouses to ship secondary packaging.
- Its mail goal is to properly protect shipments during their time in transit.
- Tertiary packaging is typically not seen by consumers.
- Examples include the pallets that bulk shipments are placed on, corrugated pads used to separate layers of boxes and stretch wrap used to secure stacks of cartons.

1.1.6 Functions of Food Packaging

a) Containment (holding the product)

The primary function of any package is to contain the food and facilitate handling, storage, and distribution all the way from the manufacturer to the ultimate user or even the time the rest portion is utilized by the consumer.

b) Protection (quality, safety, freshness)

One of the most important function of any container is to protect the product contained against any form of loss, damage, deterioration, spoilage, or contamination that might be encountered throughout the distribution chain. Generally packaging can prevent or protect the product from;

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

c) Preservation

The right selection of packaging materials and technologies maintains product quality and freshness during distribution and storage. Materials that have traditionally been used in food packaging include glass, metals (aluminum, foils and laminates, tinplate, and tin-free steel), paper and paperboards, and plastics.

d) Communication (graphics, labels)

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

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

e) Convenience (utility of use)

Providing convenience (sometimes referred to as utility of use or functionality) to consumers has become a more important function of packaging. Range of sizes, easy

handling, easy opening and dispensing, resealability, and food preparation in the package are examples of packaging providing convenience to the consumer.



Figure 1.7. Different food packaging

1.2 Identifying and confirming Cleaning and maintenance requirements

1.2.1 Definition of terms

Cleaning is the process of removing as much soil, dirt and organic matter clinging to fresh fruits and vegetables as possible.

Sanitation is defined as the means by which the health of people and the cleanliness of homes and cities is managed.

A detergent is a chemical agent that reduces the surface tension of water, thus helping particles become dislodged from surfaces and suspended in water.

Maintenance is a regular and routine action taken on equipment in order to prevent its breakdown.

1.2.2 Cleaning and disinfection of fresh vegetables

Fruits & vegetables should be washed as needed to remove soil or other contamination. Water used for washing, rinsing, or conveying final food products should be of potable quality. Fruits and vegetables that are already cleaned & sanitized for microbial reduction should be stored separately from untreated fruits and vegetables. Wash fruits and vegetables with water, in this case: Make sure that water quality accordance to standards. Water should be changed regularly to avoid accumulation of organic matter and prevent microbial contamination spread to fresh fruits and vegetables. Wash water temperature should be higher 50^0C than the temperature of fresh fruits and vegetables to avoid sucking water.

- Cleaning Different approaches:
  - ✓ Foam cleaning
  - ✓ Manual cleaning
  - ✓ Cleaning in place (CIP)
  - ✓ Clean out place (COP)

Clean-in-place (CIP) is a method of cleaning the interior surfaces of pipes, vessels, process equipment, filters and associated fittings, without disassembly. The benefit to industries that use CIP is that the cleaning is faster, less labour-intensive and more repeatable, and poses less of a chemical exposure risk to people.

Advantages

- Cleaning is faster

- Less labour with safety
- Less chemical exposure risk
- Easily carried out frequently
- Reverse and forward flow without changing connections
- Higher energy efficiency
- No need of frequent replacement of Gaskets.

1.2.3 Maintenance requirement

A maintenance schedule should be developed and maintained for the facilities, machinery and equipment;

a) Preventative maintenance

- Schedule and perform regular inspections of equipment.
- Conduct regular cleaning of buildings, grounds and assets.
- Lubricate moving parts to reduce wear-and-tear.
- Adjust controls for optimal performance and energy efficiency.
- Repair and replace any defective equipment parts.

b) **Corrective maintenance**

Carried out in such a way that production on adjoining lines or equipment is not at risk of contamination and post maintenance verification to be get recorded. Lubricants, heat transfer fluids or any other similar material used shall be food grade where there is a risk of direct or indirect contact with the product. It is recommended as best practice to maintain plant equipment's breakdown records. Loose items control policy (Nut & bolts, Nails broken pieces or smaller parts of machines) should be followed to prevent any contamination with product or packaging material.

1.3 Fitting and adjusting machine components and related attachment

The major components of the cooling system are the water pump, freeze plugs, the thermostat, and the radiator, cooling fans, the heater core, the maintains the engine operating temperature where it works most efficiently; and finally, it brings the engine up to the right pressure cap, the overflow tank and the hoses. To understand how the cooler works and what it does, it is first

necessary to trace the path of the liquid mixture through the cooler valve. The adjustment of cooler machine include; first, it removes excess heat from the engine; second, it operating temperature as quickly as possible.

a) Refrigerator's component 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. Check and make sure there is no foreign matter on:

- Inspect all lines and hoses (refrigerant, capillary, and superheat)
- Inspect associated refrigerant valves
- Check for proper refrigerant levels
- Check the system superheat at the condensing unit
- Check all valve caps and unit covers, replace any which are missing
- Inspect and replace all filters and strainers
- Inspect and replace gaskets and mechanical seal
- Monitor vibrations and temperature
- Perform a major overhaul

There are 5 components of refrigerator. These are:

- Compressor
- Condenser
- Evaporator
- Capillary tube
- Thermostat
- Receiver

- **Compressor**
  - ✓ It is the heart of the fridge.
  - ✓ The compressor circulates the refrigerant throughout the system.
  - ✓ It makes the refrigerator hot by putting pressure on the warm part of the circuit.
  - ✓ It consists of a motor that sucks in the refrigerant from the evaporator and compresses to make a hot and high-pressure gas.
  - ✓ It can compress and convert low-temperature to high-temperatures.
  - ✓ It causes an increase in pressure, and heat can be easily released.
- **Condenser**
  - ✓ It sits in the back of the fridge.
  - ✓ It extracts heat from the refrigerant.
  - ✓ It cools down the refrigerant and changes the matter. That means it changes gas back into liquid. This is the refrigerator cooling system.
  - ✓ Fans above the condenser unit draw air over the condenser coils. These fans are placed above the condenser.
  - ✓ -12 degree to -1degree C should be the range of temperature of condensation.
  - ✓ The vapour cools down to become liquid refrigerant
- **Evaporator**
  - ✓ The evaporator in the refrigerator is located inside a fridge and makes the items in the refrigerator cold.
  - ✓ It removes the unwanted heat from the food items through liquid refrigerant.
  - ✓ The pressure of the liquid refrigerant must be low.
  - ✓ Two factors determine the low pressure- first, heat gets absorbed from the product to the liquid refrigerant and the second one is the removal of air pressure by the compressor.
  - ✓ Through evaporation, the refrigerant turns liquid into a gas and cools down the area. Hence, it produces the appropriate environment for storing and preserving food.
- **Capillary tube**
  - ✓ It is an expansion device and a thin piece of tubing.

- ✓ Through the capillary tube, the liquid refrigerant is routed and sprayed into the low-pressure environment of the evaporator.

- **Thermostat**
  - ✓ It controls the cooling process in the fridge by monitoring the temperature and switching the compressor on and off.
  - ✓ When it's cold enough inside the fridge, the sensor can sense that and turn off the compressor.
  - ✓ When it senses too much heat, it switches the compressor on, and the cooling process begins again.
  - ✓ Capacity control system
  - ✓ It regulates the power and energy consumption
  - ✓ It manages dehumidification and decreases the compressor cycling.
  - ✓ It has an on/off option, which is the simplest form of capacity control.
- **Receiver**
  - ✓ The receiver acts as a vapour seal.
  - ✓ These are made for both horizontal and vertical installation.

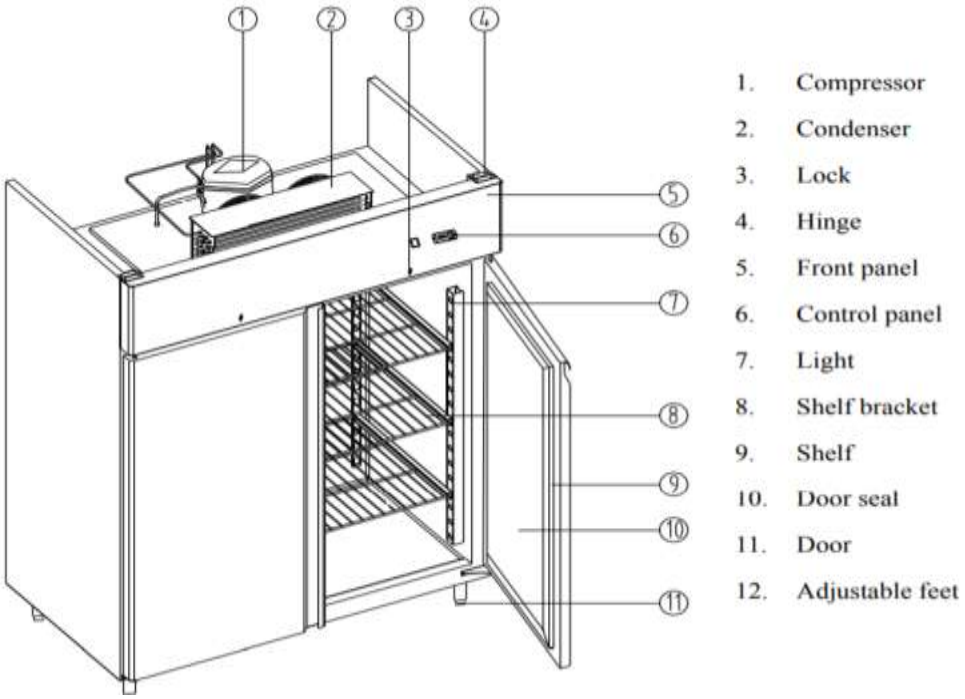


Figure 1.8 component of refrigerator

b) Vacuum packaging machine

Double chamber vacuum packing machine is a typical type of chamber vacuum sealer, designed for the small and medium-size production capacity of vacuum sealing. Compared to single chamber vacuum sealer, a double chamber vacuum packing machine owns 2 working chambers and 1 swingable chamber cover. The two chambers work alternatively to enhance the vacuum packing speed of the double chamber vacuum packing machine to 2 times of single chamber vacuum sealer.



Figure 1.9 Components of Vacuum packaging machine

I. Chamber lid
II. Handles
III. Silicones strips ,bag opening press bar
IV. Connecting rod
V. SUS304 frame
VI. Emergency stop
VII. Vacuum pump
VIII. Control panel

IX. Wheels with and anchor bolts

https://www.youtube.com/watch?v=VN2x9Y-EKXE(access date 17/01/2023).

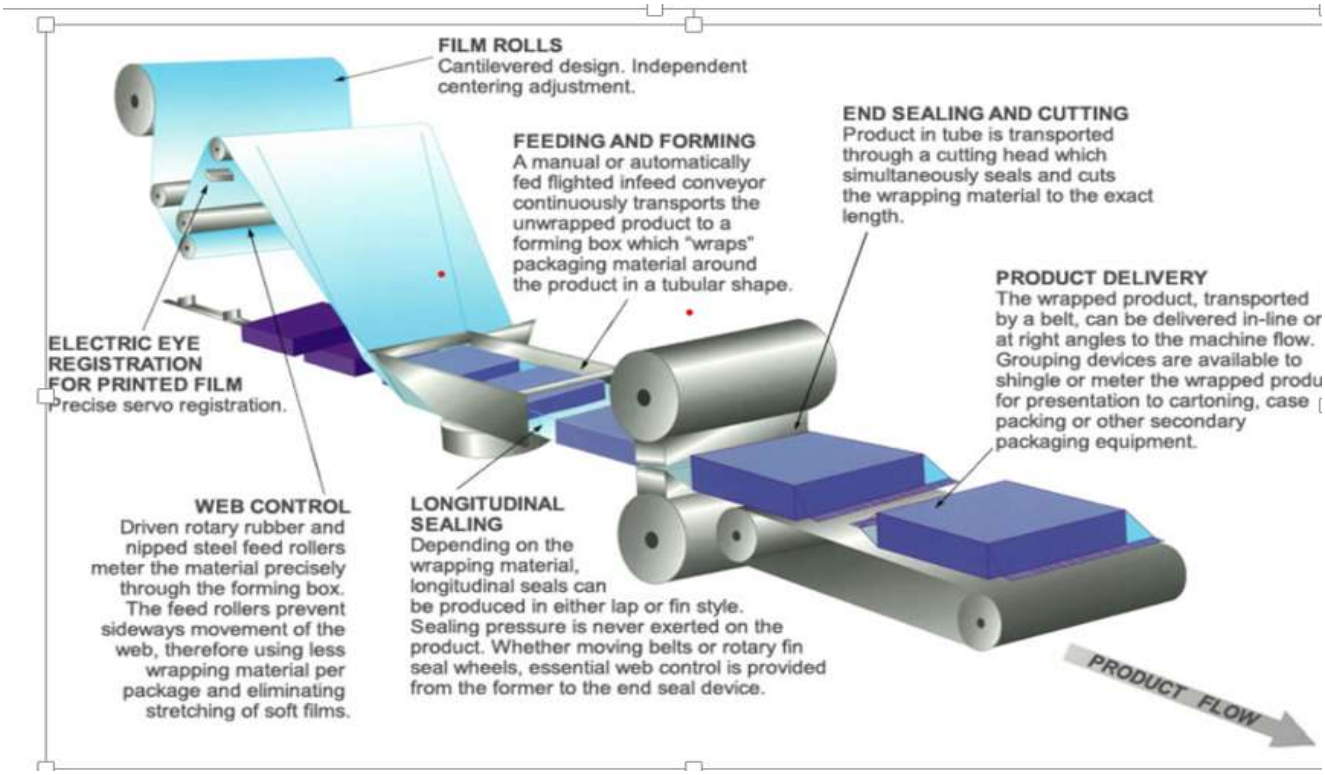


Figure-1.10 wrapper

https://www.youtube.com/watch?v=yAovjHmxAds**(accessdate22/01/2023)**

1.4 Entering processing/operating parameters

The cooling of fruits and vegetables in hydro cooling system can be a suitable technique. While the use of cold water is an old and effective cooling method as the water is better heat transfer medium than air, consequently the rate of cooling is faster than forced air ventilation method. This work aimed to define cooling time for fruits and vegetables of different sizes, presenting practical indexes that could be used to estimate cooling time for produce with similar characteristics. Cooling time varied proportionally to produce volume (from 8.5 to 124 min for fruits and from 1.5 to 55 min, for vegetables). The relationship between volume and time needed to cool fruits (from 1.03 min cm-3 to 0.107 min cm-3) and vegetables (from 0.06 min cm-3 to 0.12 min cm-3) is an index that could be used to estimate cooling time for fruits and vegetables. Some examples of critical process parameters

- Cooling time
- Temperature
- volume
- Pressure
- Speed
- Humidity
- Loading unit
- air flow/fan

1.5 Checking and adjusting equipment performance

All equipment to be used in processing or preserving foods must be inspected and checked to determine their condition prior to use and even after using them. Inspecting and checking the equipment before, during and after used very crucial. Pre-set the size of the packaging film according to the packaged product. Every piece of packaging machinery has an ideal cycle time (the time it takes to complete one finished product). Performance is measured against that ideal cycle time. So for the calculation of Overall Equipment Effectiveness (OEE) performance represents the speed at which the machine is currently running as a percentage of its ideal speed. Idle time, minor stoppages, and overall reduced operating speeds will negatively affect packing machine performance. In the packaging equipment world, a changeover is adjusting a machine to

accommodate different products. Changeovers mean the machine is offline and not producing, which equals money down the drain.

I. Overall equipment effectiveness (OEE)

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

II. Total effective equipment performance (TEEP)

It is a closely related measure which quantifies OEE against calendar hours rather than only against scheduled operating hours. A TEEP of 100% means that the operations have run with an OEE of 100% 24 hours a day and 365 days a year (100% loading). The generic form of OEE allows comparison between manufacturing units in differing industries.IOEE measurement is also commonly used as a key performance indicator (KPI) in conjunction with lean manufacturing efforts to provide an indicator of success.

- **Factors Affecting Overall Equipment Effectiveness (OEE**)

Packaging machinery manufacturers institute (PMMI's) Primary Packaging Line Play book explains that Overall Equipment Effectiveness is a combination of three factors:

- **Availability** - Making things at the right time (keeping the machine up and running, minimizing downtime)
- **Performance** - Making the right thing
- **Quality** - Making things the right way (no defects, rework, or waste)

Many manufacturers benchmark their industry to set a challenging target; 85% is not uncommon.

- OEE is calculated with the formula (Availability)*(Performance)*(Quality)

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

1.6 Carrying out pre-start checks.

Before putting Cold-Room into operation, it is necessary to carry out a series of checks to prevent errors or accidents during the activating phase: Checks

- That there has not been any damage to the upright and/or table Cold-Room during assembly.
- With care the integrity of the control panel, the electric cable and the tubes.
- The precise connection to external energy supply.
- The free movement and rotation of any moving parts.
- That the cables and the sockets are suitable for the power absorbed by the equipment.
- The use of adaptors, multiple sockets and/or extension leads is forbidden.
- Ensure that the upright and/or table Cold-Room is not installed near to sources of heat like: ovens, radiators, direct sunlight etc.
- Leave a space of at least 75 mm (3 inches) between the back of the upright and/or table Cold-Room and any wall, to avoid the formation of condensation.
- The motor must be free of any obstacle which could hinder or limit the circulation trough the condensing unit situated on the top side part of the Cold-Room.
- The distance between the Cold-Room and the ceiling must be less 50 cm. (19 ¾ inches).
- Check that the environment has a sufficient change of air, in order to guarantee the cooling of the condenser and the compressor unit.
- For a perfect functioning of the equipment, the maximum temperature of the environment Should not exceed +43°C (109 °F), except for static models which should not exceed +32°C (+95°F).
- Lack of respect for these conditions will provoke a serious decline in the functioning of the equipment, early ageing of the compressor and a much higher consumption of energy than normal

Self-Check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test I: Choose the best answer (each 2 point)

1. From the following, which is not true about the ccharacteristics of fresh Fruits and Vegetables
   a. high moisture content
   b. high respiration rate
   c. high perishability
   d. low perishability
2. Packages include:
   a. Flexible sacks
   b. Wooden crates
   c. Cartons (fiberboard boxes)
   d. Plastic crates
   e. Pallet boxes and shipping container

3._____ is a regular and routine action taken on equipment in order to prevent its breakdown.

   a. Maintenance
   b. sanitation
   c. disinfection
   d. all

Test II: Short Answer Questions (each 2 point)

1. List the components of blast freezer?
2. Define packaging?
3. List the condition should be checked before start using any machine?
4. Write down the functions of food packaging?
5. Write types of Maintenance?

6. List the purpose of machine Maintenance?
7. What Are the Common Applications of Polyethylene?

OperationSheet 1

1.2. Cleaning refrigerator

A. Tools and equipment

- glove
- Freezer
- PPE
- Voltmeter, test light, Wrenches and screw drivers

B, Procedures for cleaning refrigerator

I. Wear personal protective equipment's
II. .Unplug refrigerator or disconnect power.
III. Initially wash with water to remove surface dirt (or dry-clean for delicate commodities).
IV. Wash with sanitizing agent (usually chemical disinfectant) or Caustic wash (140°F-185° F)
V. Perform a final rinse with water.
VI. Sanitizing Rinse
VII. Replace the base grille when finished.
VIII. Plug in refrigerator or reconnect power



Quality criteria for refrigerator:

- ✓ **Use recommended cleaners**

1.4. Temperature Adjustment for refrigerator

A. tools and equipment

- Freezer
- PPE
- Thermometer
- Hygrometer

B. Procedure for Adjust Temperature

I. Refrigerator set point range: 33°F to 42°F (0°C to 5.5°C).
II. Wear Personal protective equipment
III. Press and hold temperature for 3 seconds to activate
IV. Press the Light button, under Units, when adjust mode is activated.
V. Activate Temperature mode
VI. When Temperature mode is activated, press TEMP to toggle between Fridge and Freezer
VII. To return the display setting to Fahrenheit, press the light button again
VIII. Press temperature to select the Refrigerator zone.
IX. The temperature set point is appears on the display screen/ temperature adjusting information will appear on the display screen.
X. Press lock to raise the set point, or press options to lower the set point.
XI. When you have finished viewing (and adjusting if desired) the refrigerator set point, press temperature, under Select Zone, to change the display to show the freezer set point. When the zone has been changed, "freezer" appears on the display screen.
XII. Press the Lock button to raise the set point, or press the Options button to lower the set point.
XIII. Save/Confirm Temperature Settings
XIV. When you have finished adjusting both the refrigerator and freezer set points, press measured fill to confirm and to save the settings.
XV. Exit Temperature mode without saving changes, press the Ice/Water button under back at any time, or allow about 60 seconds of inactivity.
XVI. The temperature mode will turn off automatically and return to the normal screen
XVII. Clean the refrigerator



Quality criteria:

- **Set temperature (0°C to 5.5°C).**

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

Task-1. Perform cleaning the refrigerator

Task -2. Adjust right temperature for refrigerator

LG #20	LO#2Operate and Monitor the Cooling and Wrapping Process

Instruction sheet

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

- Starting and operating the cooling and wrapping process
- Identifying and monitoring equipment variation in operating conditions.
- Identifying and reporting Variation in equipment operation on the control panel board
- Monitoring the process to confirm that product cooled and packed
- Identifying, rectifying and reporting Out-of-specification product/process outcomes.
- Maintaining the work area housekeeping standards
- Conducting work with workplace environmental guidelines
- Maintain Workplace records

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

- Start and operate the cooling and wrapping process according to workplace procedures.
- Identify and monitor equipment variation in operating conditions.
- Identify variation in equipment operation on the control panel board and maintenance requirements
- Monitor the process to confirm that product cooled and packaged to meet specifications.
- Identify, rectify and/or report out-of-specification product/process outcomes to maintain the process within specification.
- Maintain the work area according to housekeeping standards.
- Conduct work accordance with workplace environmental guidelines.
- Maintain workplace records according to workplace recording requirements.

Learning Instructions:

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

Information Sheet 2

2.1 Starting and operating the cooling and wrapping process

2.1.1 Definition of terms

Cooling is an essential process for almost all fruits and vegetables unless they are intended for marketing directly from the field in local markets. It offers a number of benefits for perishable commodities.

Pre-cooling is a term used to describe the rapid removal of field heat from produce soon after harvest.

2.1.2 Principle of pre cooling

Immediately after harvest, fresh produce temperature can be high. To extend the shelf life of fresh produce and to sustain quality of fruits and vegetables, products are generally cooled within 24 hours after harvesting. In the cooling process, excessive heat is removed from the product by a cooling medium, in most cases by air, water or ice. Cooling is the foundation of produce quality protection as it slows metabolic processes and microbial growth. Cooked food as cooled from 70°C to 3°C cooled in less than 90 minutes times than can be used for store later consumption in a safe manner. This techniques as used in food catering. Presently for instant food this helps to ensure quality and safety. Blast chiller operate between 3°C to 5°C. These are maximum used for commercial purpose. The danger zone is between 41°F and 135F°. Room temperature is considered as danger zone.

Desired temperature and relative humidity (RH) for vegetable storage are usually achieved by mechanical refrigeration system which is expensive .It also limits the growth of some human pathogens, thus proper cooling is a strategy for helping to ensure the safety and quality of fresh produce. For example, Cans are cooled rapidly to 39˚C to stop the process and to prevent the stack burning. Either cooling is done by dipping or immersing Can in cold water tank or by spraying jet of cold water.Immediately after processing, the bottle are cooled in water to a temperature of 36°C to 42°C to avoid thermophiles spoilage or bottle rust. The selection of the precooling method depends on three main factors: the temperature of the produce at harvest, the physiology of the produce and the desired post-harvest life.

Cooling Methods for Fruit and vegetables:

- Room cooling
- Forced-air cooling
- Hydro-cooling
- Ice cooling
- Vacuum cooling
- Evaporative cooling

a) Room cooling

It is the most common cooling method where produce in boxes, cartons, bulk containers or other packages is exposed to cold air in a cool store. Air velocities around the packages should be at least 60 meters per minute. This widely used method involves the placing of produce in boxes (wooden, fibreboard or plastic), bulk containers or various other packages into a cold room, where they are exposed to cold air. It is used for produce sensitive to free moisture or surface moisture. Because this type of cooling is slow, room cooling is only appropriate for very small amounts of produce or produce that does not deteriorate rapidly.

b) Forced air (pressure) cooling:

The principle behind this type of precooling is to place the product into a room where cold air is directed through the crop after flowing over various refrigerated metal coils or pipes. Forced air-cooling systems blow air at a high velocity leading to desiccation of the crop. To minimize this effect, various methods of humidifying the cooling air have been designed such as blowing the air through cold-water sprays.

- In forced air-cooling, air is forced through the packages and around each piece of produce as a result cooling is faster.
- It can cool the commodity in about one forth to one tenth of the time required for room cooling.



Figure 2.1.foreced air cooling

c) Hydro cooling

Hydro cooling is the process or technique of arresting the ripening of fruits and vegetables after harvesting by immersion in cold water. It is a rapid method for cooling in which water acts as the heat transfer medium. It is maintained as close to 0^0C as possible; moving conveyor. There are many types of fruits and vegetables that respond particularly well to hydro cooling, which include Apricots, Peaches, Plums, Nectarines, Cantaloupe, Apples, Pears, Cherries, Spinach, Lettuce, Endive and other greens. Foods that should not be hydro cooled include those that are highly susceptible to wetting such as; Berries, potatoes, garlic, citrus fruits, mushrooms and grapes. **Requirements of hydro cooling:**

- The commodity must be resistant to water damage and tolerant to wetting.
- For sensitive commodities such as leafy vegetables, the drop height of water should not exceed 20 cm.
- Water-resistant containers with sufficient drain holes, e.g. plastic crates, waxed fibreboard cartons.
- Chlorinated water (150-200 ppm active chlorine) must be used for cooling to minimize the spread of disease.

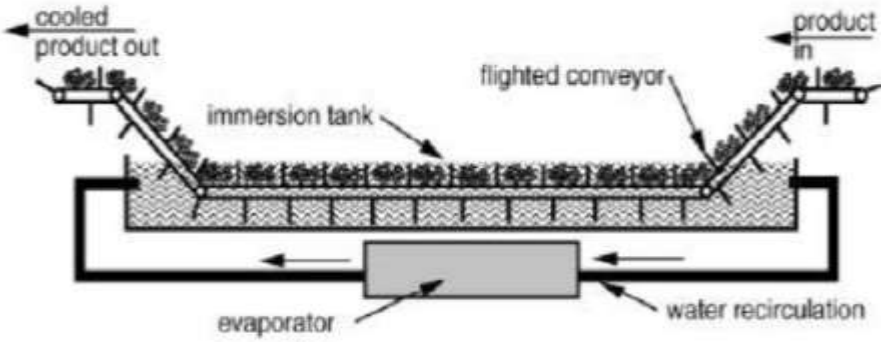


Figure 2.2 Cut-away side view of a continuous-flow immersion hydro cooler

d) Contact Icing

Ice is commonly added to boxes of produce by placing a layer of crushed ice directly on the top of the crop. An ice slurry can be applied in the following proportion: 60% finely crushed ice, 40% water, and 0.1% sodium chloride to lower the melting point. The water to ice ratio may vary from 1:1 to 1:4. as asparagus, celery, sweet corn, radishes, and carrots, but it is seldom used for fruits. Finely crushed ice or an ice slurry (liquid ice i.e. 40% water + 60 per cent ice + 0.1 per cent salt) is sprayed on to the top of the load inside the road or rail transit vehicle.

https://www.youtube.com/watch?EXFq70Kb-D8(access Date 21/01/2023)

e) Vacuum cooling

Cooling in this case is achieved with the latent heat of vaporization rather than conduction. At normal air, pressure (760 mmHg) water will boil at 100°C. As air, pressure is reduced so is the boiling point of water and at 4.6-mmHg water boils at 0°C.The speed and effectiveness of cooling is related to the ratio between the mass of the produce and its surface area. This method is particularly suitable for leaf crops such as lettuce.

f) Evaporative cooling:

Commodity can be cooled by either blowing the humidified cool air or by misting with water and then blowing dry air over the wet fruit. This method is restricted to regions having climate with low relative humidity but with a good quality water supply.It has the advantage of being low cost cooling method in which dry air is cooled by blowing it across a wet surface.

- ✓ Below 41°F to minimize bacterial growth.
- ✓ Bacterial grow most rapidly from 70 - 135°F.

https://www.youtube.com/watch?AmTeTHj1tpkcoolingmethod(access date 18/01/2023)

Table 2.1 Recommended Precooling Methods and Storage conditions for Fruits and Vegetables

Fruit	Temperature F	% Relative humidity	Precooling Method	Storage life Days	Ethylene sensitive
Apples	30-40	90-95	R, F, H	90-240	Y
Avocados	40-55	85-90		14-28	Y
Grapes	32	85	F	56-180	
Strawberries	32	85-90	R,F	5-10	
Watermelon	50-60	90	N	14-21	
Tomatoes	62-68	90-95	R, F	7-28	Y
Pineapple	45-55	85-90		14-36	
Sweet potatoes	55-60	85-90	N	120-210	Y
Orange	2-48	85-90		21-56	
Garlic	32-34	65-75	N	90-210	
Lettuce	32	85-90	H, I	14-21	Y
Onions, bulb	32	65-70	N	30-180	
Onions, green	32	95- 100	H,I	7-10	
Asparagus, broccoli			V		

F = forced-air cooling, H = hydro cooling, I = package icing, R = room cooling, V = vacuum cooling, N = no precooling needed, Y= yes.

https://www.youtube.com/watch?v=J6-Uvn0cD4s (access date 20/01/2023).

2.1.3 Starting and operating wrapping process

Wrapping is something such as paper or plastic which is used to cover and protect something.

Unprotected or poorly wrapped and/or packaged food will be vulnerable to physical damage as well as microbiological contamination and cross-contamination. Use of the wrong wrapping materials may lead to chemical contamination. Unhygienic storage and assembly of wrapping and packaging can contaminate the materials and therefore the food Wrapping and packaging can control microbial spoilage by, for example, packaging meat in protective atmospheres using varying the levels of oxygen (O2), carbon dioxide (CO2) and nitrogen (N2).

- ✓ Shrink wrap/Individual seal packaging:
- ✓ Individual seal packaging involves the use of heat that shrinkable film (usually HDPE) that is wrapped around the individual units of fruits and vegetables and shrink by blowing hot



Figure 2.3 sealer

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

Flow wrap machine operating steps:

I. Check the machine to ensure that the machine is free of faults and debris.
II. Install the packaging film on the packaging film idler, the exit direction is consistent with the in and out direction of the packaging, adjust the packaging film so that its center is consistent with the center of the longitudinal seal.
III. Turn on the power, the power indicator light is on, the display terminal displays the initial screen; after 3 seconds, the display terminal automatically displays the running screen.

IV. Press the heating circuit switch to “ON” and press the button of the temperature control meter.

V. Measure the length of the bag (the linear distance between two adjacent color codes, in millimetres).

VI. Press the start button, the machine runs, and the bag length adjustment handle (Clockwise bag length decreases, counter clockwise bag length increases). Make the bag length value displayed on the display terminal consistent with the measured bag length value.

VII. Wear the packaging film according to the schematic diagram, pull up the handle of the vertical sealing wheel, open the vertical sealing wheel, and pull the packaging film to the horizontal sealing position, put down the handle, and press the vertical sealing wheel.

VIII. Press the jog button to make the horizontal sealing cutter cut exactly on the color mark.

IX. Press the start button, start the machine, make several bags, and check the sealing effect of the vertical seal and the horizontal seal.

X. Press the start button, start the machine, make several bags, and check the sealing effect of the vertical seal and the horizontal seal.

XI. Put 1 to 2 products on the feeding conveyor, press the jog button, and stop the items before the horizontal seal, check whether the product is between the two color marks, and pay attention to whether the cutter cuts to the product.

XII. Feeding enough products, press the start button, and formally run the machine.

2.2 Identifying and Monitoring Equipment variation in operating conditions.

Monitoring is the systematic process of collecting, analysing and using information to track a programmer's progress toward reaching its objectives and to guide management decisions during homogenization. Monitoring task is a scheduled task used to detect the potential onset of a failure so that action can be taken to prevent such failure. The purpose of monitoring and evaluation is to track implementation and outputs systematically, and measure the effectiveness of programmes. It helps determine exactly when a programme is on track and when changes may be needed. Cooler and systems for which Performance of monitoring surveys may be required on a routine basis include the following items:

- Pumps – due to impeller wear, seal ring wear (re-cycling) or blockage.
- Fan Systems – due to filter blockage, blade fouling or re-cycling.
- Boilers – due to loss of thermal efficiency for many different reasons.
- Heat Exchangers – due to fouling or blockage.
- Steam Turbines – due to blade fouling and numerous other reasons.
- Air Compressors – due to wear, filter blockage, valve leakage (reciprocating), etc.
- Diesel or Gas Engines – due to loss of compression (rings or valve leakage) etc.
- Electrostatic or bag dust filters – due to fouling, shorting or leakage

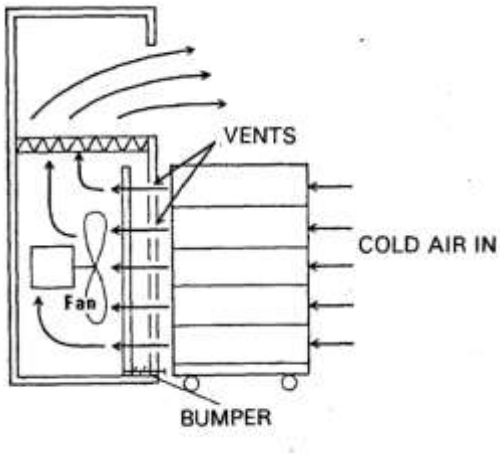


Figure 2.4 Forced-air coolers

Identifying equipment variation in the processing area is necessary to ensure accurate, reliable, and timely testing. The benefits of Identifying equipment variation program are many:

- Helps to maintain a high level of equipment performance;

- Reduces variation equipment, and improves the technologist's confidence in the accuracy of testing results;
- Lowers repair costs, as fewer repairs will be needed for a well-maintained instrument;
- Lengthens instrument life;
- Reduces interruption of services due to breakdowns and failures;
- Increases safety for workers;
- Produces greater customer satisfaction.

2.3 Identifying and reporting Variation in equipment operation on the control panel board

2.3.1 Reporting Variation in equipment operation

Panel board is single panel or group of panel units, designed for assembly in the form of a single panel, designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front. Each piece of equipment which required maintenance should have reported to the concerned person/supervisor/ manufacturer.



Figure 2.5 Reporting Variation in equipment operation

2.4 Monitoring the process to confirm that product cooling and packed

Monitoring is the collection and analysis of information about a process, undertaken while the process is ongoing in correct ways. How to Monitoring the process to cooling and packed? Atmospheric cooling can be done either in the retort or in a trough.

The required cooling time varies mainly with:

- Temperature of cooling water,
- Dimensions of the container and
- Characteristics of food (fruit and vegetable) in the container.

checking the temperature of refrigerators, chills, cold displays or freezers immediately after the door/lid has been open for any significant period of time or during a defrost. These can be useful for day-to-day monitoring but should be checked regularly with a digital thermometer as a back-up check. Avoid puncturing the packaging of wrapped food when checking temperatures. Proper overpressure in the early stage of cooling is also helpful to metal cans and glass jars in the prevention of leaking from the container and the subsequent recontamination through the leak.



Figure 2.6 Monitoring product's Temperature

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2.4.1 Monitoring storage areas

Storage areas should be designed or adapted to ensure good storage conditions. In particular, they should be clean and dry and maintained within acceptable temperature limits. Where special storage conditions are required on the label (e.g. temperature, relative humidity), these should be provided, checked, monitored and recorded. The refrigeration facilities (storage rooms) are equipped with temperature measuring devices, preferably recording thermometers. If recording thermometers are not used, maximum/minimum thermometers are used. Stock rotation (of ingredients and, where appropriate, packaging materials) is controlled to prevent deterioration and spoilage. First-in, first-out stock rotation is practiced. Humidity sensitive ingredients and packaging materials are stored under appropriate conditions to prevent deterioration. The equipment used for monitoring should be checked at suitable predetermined intervals and the results of such checks should be recorded.

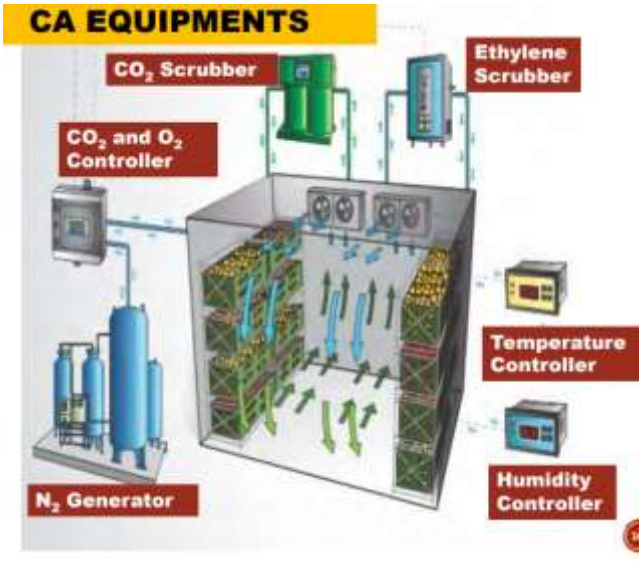


Figure 2.7 monitoring storage areas

https://www.youtube. com/watchBX2haVUQ4h5A (aceess date 21/01/2023).

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

- Laboratory Investigation
- Responsibilities of the Laboratory Supervisor

a. Laboratory Investigation

The purpose of the investigation is to determine the cause of the OOS result. The source of the OOS result should be identified either as an aberration of the measurement process or an aberration of the manufacturing process. Even if a batch is rejected based on an OOS result, the investigation is necessary to determine if the result is associated with other batches of the same drug product or other products. Batch rejection does not negate the need to perform the investigation. The regulations require that a written record of the investigation be made, including the conclusions and follow-up.

Factors that can cause Out of Specification (OOS) results in a laboratory include

- Incorrect handling of the sample
- Use of wrong reagents
- Equipment not calibrated
- Sample not incubated for the correct time and temperature
- Possible contamination of sample
- Incorrect reading of the result
- Not reporting to the correct units of measurement

b. Responsibilities of the Laboratory Supervisor

The first responsibility for achieving accurate laboratory testing results lies with the analyst who is performing the test.

The following steps should be taken as part of the supervisor's assessment

- Discuss the test method with the analyst; confirm analyst knowledge of and performance of the correct procedure.
- Examine the raw data obtained in the analysis, including chromatograms and spectra, and identify anomalous or suspect information.

- Verify that the calculations used to convert raw data values into a final test result are scientifically sound, appropriate, and correct; also determine if unauthorized or invalidated changes have been made to automated calculation methods.
- Confirm the performance of the instruments
- Determine that appropriate reference standards, solvents, reagents, and other solutions were used and that they met quality control specifications.
- Evaluate the performance of the test method to ensure that it is performing according to the standard expected based on method validation data and historical data.
- Fully document and preserve records of this laboratory assessment

2.5.1 Investigating OOS test results Phase II: full scale OOS investigation

a) Review of Production

The investigation should be conducted by the QCU and should involve all other departments that could be implicated, including manufacturing, process development, maintenance, and engineering. In cases where manufacturing occurs off-site (i.e., performed by a contract manufacturer or at multiple manufacturing sites), all sites potentially involved should be included in the investigation. Other potential problems should be identified and investigated.

b) Additional Laboratory Testing

A full-scale OOS investigation may include additional laboratory testing. A number of practices are used during the laboratory phase of an investigation. These include (1) retesting a portion of the original sample and (2) resampling.

I. Retesting

Part of the investigation may involve retesting of a portion of the original sample. The sample used for the retesting should be taken from the same homogeneous material that was originally collected from the lot, tested, and yielded the OOS results.

II. **Resampling**

While retesting refers to analysis of the original, homogenous sample material, resampling involves analysing a specimen from any additional units collected as part of the original sampling procedure

or from a new sample collected from the batch, should that be necessary. The original sample from a batch should be sufficiently large to accommodate additional testing in the event an OOS result is obtained. In some situations, however, it may be appropriate to collect a new sample from the batch. Control mechanisms for examination of additional specimens should be in accordance with predetermined procedures and sampling strategies.

2.6 Maintaining the work area housekeeping standards

Effective housekeeping can help control or eliminate workplace hazards. Poor housekeeping practices frequently contribute to incidents. Housekeeping is not just cleanliness. It includes keeping work areas neat and orderly, maintaining halls and floors free of slip and trip hazards, and removing of waste materials (e.g., paper, cardboard) and other fire hazards from work areas. It also requires paying attention to important details such as the layout of the whole workplace, aisle marking, the adequacy of storage facilities, and maintenance. Good housekeeping is also a basic part of incident and fire prevention.

- Benefits of good housekeeping practices Effective:
  - ✓ reduced handling to ease the flow of materials
  - ✓ fewer tripping and slipping incidents in clutter-free and spill-free work areas
  - ✓ decreased fire hazards
  - ✓ lower worker exposures to hazardous products (e.g. dusts, vapours)
  - ✓ better control of tools and materials, including inventory and supplies
  - ✓ more efficient equipment clean-up and maintenance
  - ✓ better hygienic conditions leading to improved health
  - ✓ more effective use of space
  - ✓ reduced property damage by improving preventive maintenance
  - ✓ less janitorial work
  - ✓ improved morale

2.7 Conducting work with workplace environmental 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. Successful performance of the packaging function depends first on recognizing that the result must serve marketing and distribution purposes. Implemented, proposed and/or impending Federal and State legislation prohibits wasteful and/or excessive packaging. The challenge then is to meet these requirements with the amount and degree of packaging required without excess. Over packaging and wasteful "just in case" packaging is undesirable for both the supplier and the user. Environmental guidelines for packaging should be as follow

- Biodegradable packaging materials
- Hazardous waste management and disposal services.
- Providing fire prevention, inspection, engineering and systems maintenance services; and
- 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,
- 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;
- Wax or plastic coated paper is prohibited because it contaminates the recycling process.
- Non-craft corrugated has no recycle value and therefore is unacceptable. Recycling centres will not accept it; therefore, rail industry suppliers shall not use it.

- The use of lead and cadmium in packaging and/or labelling material is strictly prohibited.
- Plastic plugs, caps and protectors are extremely difficult to recycle due to oil and paint contamination, color, uncertainty of resin type, and transportation costs. Every effort should be made to reduce the use of plastic. If it cannot be eliminated, other changes can be made to assist with the effectiveness of the packaging:
- When elimination is not possible these codes will allow for effective recycling.
- Clear Linear Low Density Polyethylene (LLDPE) plastics are preferred and can be effectively recycled.
- Shipping plastics must not be contaminated with paints and lubricants.

Self-Check –2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test I: Short Answer Questions

1. List the types of cooling;----------
2. Write down the steps of cooling:----------
   ----
3. Define the importance of monitoring equipment:----------
4. Write workplace environmental guidelines

Operation Sheet 2

2.4 Follow Procedure of monitor cold room's temperature

A. **Tools and equipment**

- Glove
- Mask
- Goggles
- Apron/gown
- Safe shoes

B. Method/techniques to monitor cold room's the temperature

I. Water and ice for cooling must be free of pathogenic microbes (potable quality).

II. Regularly perform microbial testing of water used for cooling and icing.

III. Ice must be produced from sanitized water and stored under sanitary conditions.

IV. Cooling water that is being recirculated must be sanitized (e.g. by chlorine).

V. Clean freezer

Quality criteria

- Adjust thermometer accurately(Recommended storage temperatures differ with the maturity of the fruit)

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

Task-1 Perform monitoring of cold room temperature

LG #21	**LO #3-Monitor and Inspect Closure And Seams.**
Instruction sheet	

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

- Monitoring the closing stage to confirm that closures and seams meet specifications.
- Inspecting and identifying seam out-of-specification.
- Identifying, rectifying and reporting out-of-specification process and equipment performance

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:

- Monitor the closing stage to confirm closures and seams meet specifications.
- Inspect Seams to identify out-of-specification seams.
- Identify , rectify and/or report out-of-specification process and equipment performance

Learning Instructions:

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

Information Sheet- 3

4.1 Monitoring the closing stage to confirm that closures and seams meet specifications.

4.1.1 Monitoring closing stage and seams

A closure is a device used to close or seal a container such as a bottle, jug, jar, tube, or can. A closure may be a cap, cover, lid, plug, liner, or the like. The part of the container to which the closure is applied is called the finish. A double seam is a canning process that creates a seal between the can body and lid (also known as Can end). It does this by mechanically interlocking five layers of material together three layers of the can lid and two layers of the can body. This process creates a hermetic seal to keep the contents protected from contamination or degradation. The combination of materials used to make a can have expanded massively since the double seam was first introduced. From traditional tin or steel to aluminium or plastic, there are a huge variety of ways to double seam a can.

This is achieved with a double seaming machine and while the machines themselves vary, there are three main stages to the seaming process.

a. **Compressio**n – the body of the can is tightly held in place while the lid is lowered into the correct position, ready for interlocking to take place
b. **1st roller operation** – the lid is hooked over the edge of the can and a roller pushes against the lid's flange until it folds neatly round the body's edge
c. **2nd roller operation**

The Second roller applies pressurized force to the can's hook, creating a double seam that is completely interlocked and hermetically sealed. A can seamer is a machine used to seal the lid to the can body. The lid or "end" is usually tinplated steel or aluminium while the body can be of metal, paperboard or plastic. The seam formed is generally leak proof, but this depends on the product being canned. Suitable closing of the container is necessary because

- It prevents loss of material by spilling or volatilization.
- It prevents the deterioration of product from the effects of environment such as moisture, oxygen, or carbon dioxide.
- It avoids contamination of the product from dirt, microorganism or insects. Materials used for making closures:-
    - ✓ Cork

- ✓ Glass
- ✓ Plastic
- ✓ Metal

3.1.2. Control of closures and seam food product

Regular observations shall be maintained during production runs for gross closure defects. Any such defects shall be recorded and corrective action taken and recorded. The operator, closure supervisor, or other container closure inspection person shall visually examine either the top seam of a can randomly selected from each seaming head or the closure of any other type of container being used. These examinations and a record of the observations shall be made at intervals of sufficient frequency to ensure proper closure. All pertinent observations shall be recorded. When irregularities are found, the corrective action shall be recorded. For glass containers with vacuum closures, capper efficiency shall be checked by a measurement of the cold water vacuum. This shall be done before actual filling operations, and the results shall be recorded.

- A jam in a closing machine;
- A closing machine adjustment; and
- A start-up of a closing machine following a prolonged shutdown.



Figure 3.1. R a s p b e r r y J a m

4.2 Inspecting and identifying seam out-of-specification.

3.2.1 Definition of terms

The term out of specifications (OOS), are defined as those results of in process or finished product testing, which falling out of specified limits.

a) Cut Seam

This seam defect happens when the seam is extremely tight. It causes fractures to the can seam's outer layer.

- Possible Causes and Solutions

  - ✓ Too tight 1st and 2nd seaming rollers.
  - ✓ Loosen the 1st and 2nd seaming roller operations.

b) Droop.

This is an overhang in the normal seal's bottom which gives the seam's bottom edge a scalloped appearance. It may happen at any part around the double seam. However, a droop is mostly found where the can's seam crosses the can body's side seam in 3-piece cans.

- **Possible Causes**

  - ✓ Too great pressure in the turntable.
  - ✓ Too loose first roller operation.
  - ✓ Trapped food in the seam.
  - ✓ Dented or bent cans.
  - ✓ Worn out 1st seaming roller.

- **Solutions**

  - ✓ Decrease the pressure in the turntable. Check the spacers if the number is appropriate for your can's size.
  - ✓ Tighten the first roller operation.
  - ✓ Clean the can's edge thoroughly before resuming the seaming process.
  - ✓ Inspect your cans for any defects before using them.
  - ✓ Replace 1st seaming roller.

c) False Seam

This is a very serious can defect which can cause food leakage from the container. You can see it on the can's outside portion through close inspection. The can's edges and the lid will be pushed towards the can but no hooks are formed.

- **Possible Causes**
  - ✓ Damaged or bent can edges or lid.
  - ✓ Overfilled can and/or trapped food in the seam.
  - ✓ Too loose 1st seaming roller operation.
  - ✓ Too tight 2nd seaming roller operation.
- **Solutions**
  - ✓ Inspect the lids and cans for any damage before you use them.
  - ✓ Check the can's fill and clean the can's edge thoroughly before resuming the seaming process.
  - ✓ Tighten the 1st seaming roller.
  - ✓ Loosen the 2nd seaming roller.

d) Incomplete Seam

In this double seam defect, the seam will be unfinished or some parts around the finished seam will be loose.

- **Possible Causes**
  - ✓ Too low or too high pressure from the turntable.
  - ✓ Worn seaming chuck.
  - ✓ Seaming rollers do not rotate freely.
  - ✓ Grease or oil is present on the turntable and/or seaming chuck.
- **Solutions**
  - ✓ Check instructions on your Can sealer regarding the recommended number of spacers for your Can's size.
  - ✓ Replace the seaming chuck.
  - ✓ Oil, repair, or clean the seaming rollers.

- ✓ Clean the turntable and/or seaming chuck.

e) Cut-Over and Sharp Seam

This is a sharp seam edge that you can usually feel by running your fingers around the lid seam's inside portion. It can indicate a cut-over defect in which there is a fracture in the seam. Cut-over and sharp seam defects have similar possible causes and solutions.

- **Possible Causes**

  - ✓ Too tight 1st and/or 2nd seaming roller operations.
  - ✓ Trapped food in the seam.
  - ✓ Too great pressure from the turntable.
  - ✓ Worn chuck head and/or seaming rollers.

- **Solutions**

  - ✓ Loosen 1st and/or 2nd seaming rollers.
  - ✓ Clean the can's edge thoroughly before resuming the seaming process.
  - ✓ Decrease pressure on the turntable. Check the spacers if the number is appropriate for your can's size.
  - ✓ Replace the chuck head and/or seaming rollers.

f) Vee

This is a pointed and sharp overhang found on the normal seam's bottom edge. When your can has vees, it means that the edges of the can body and the lid did not interlock correctly.

- **Possible Causes**

  - ✓ Too great pressure in the turntable.
  - ✓ Too loose first roller operation.
  - ✓ Trapped food in the seam.
  - ✓ Too tight 1st seaming roller operation.
  - ✓ Worn 1st seaming roller.

- **Solutions**

  - ✓ Decrease the pressure in the turntable. Check the spacers if the number is appropriate for your can's size.

- ✓ Tighten the first roller operation.
- ✓ Clean the can's edge thoroughly before resuming the seaming process.
- ✓ Loosen the 1st seaming roller.
- ✓ Replace 1st seaming roller.

3.2.2 Can Seam Inspection

A leaking double seam must be avoided to ensure canned product quality. There are several methods and measurements used to inspect the soundness of a can seam.

I. Visual inspection

Visually inspecting the external double seam is a valuable tool in maintaining double seam quality. In food canning processes, visual inspection of each container is performed from each seaming station at least every 30 minutes. The inspector is looking for deviations in the double seam as she traverses around the seam. Typical problems found visually include seam and droops. Seam bumps are difficult to see because the deviation is small. In practice, visual inspections identify 80% to 90% of seam quality problems.

II. Seam thickness

The thickness of the finished seam. There are specified ranges of seam thickness for all can types. The seam thickness measurement is an indicator of the overall pressure that is applied during the seaming operation. Seam thickness is often tested with a seam micrometer.

III. Seam height

Seam Height is another measurement that indicates overall pressure applied during the seaming operation. Like seam thickness, a seam micrometre is used to measure.

IV. Seam impression

The seam impression is left inside of the can body as seamer rollers push the cover and body hook materials together and against the seaming chuck. The can liner can become damaged if too much pressure is applied.

V. Cover hook wrinkles

Inspecting the cover hook wrinkling is a more reliable indication of proper seaming pressure. As the various parts of the seam are pressed together due to the differences in radius, wrinkles naturally occur in the inside radius of the cover hook. You can ensure your seamer is operating

properly and determine that the correct pressure is being applied by measuring the depth, type and quantity of cover hook wrinkles.

4.3 Identifying, rectifying and reporting Out-of-specification process and equipment performance

The term out of specifications (OOS) are defined as those results of in process or finished product testing, which falling out of specified limits. OOS may arise due to deviations in product manufacturing process, errors in testing procedure, or due to malfunctioning of analytical equipment. During tomato packaging out of specification occur due:

- The interior of the Can shall show any black discolouration,
- rusting
- Pitting.
- Incorrect filling procedure
- When Packaging material not to compatible with food
- The water holding capacity of the container shall be the volume of distilled water at 20 °C which the sealed container shall hold when completely filled.
- food grade not acid resistant
- Net weight in grams not stated correctly.
- Poor list of ingredients
- Unknown Date of manufacture;
- When state the 'Sell by date; and expired date
- On Instructions on label. How to use immediately after opening the container'.



Figure 3.2 checking sealing

3.3.1 Equipment performance

Total effective equipment performance (TEEP) is one of the two closely-related measures indicating how well a manufacturing operation is utilized: Overall Equipment Effectiveness, or OEE, measures the percentage of scheduled production time that is fully productive. TEEP measures the percentage of total calendar hours that are fully productive. The difference between the two is simply the maximum time that is available for production, which for TEEP is 24 hours a day, 365 days a year. Its advantage is that it provides an insight into the true potential of a manufacturing operation.

How is TEEP calculated?

To calculate total effective equipment performance, you first need an overall equipment effectiveness (OEE) score which is based on the following three factors:

Availability: also known as uptime, this is the percentage of scheduled time when production is actually taking place.

Performance: the speed at which production takes place as a percentage of the intended speed.

Quality: the number of products of acceptable quality as a percentage of the total products started.

Using the factors above, you would calculate an OEE score as follows:

Availability x performance x quality = % overall OEE

To understand what those percentages mean in the real world, you can measure it against the metrics listed below:

60%-65%=typical

85%=world-class

00% = perfection. No downtime, operating at optimum speed, and no poor products.

Using the OEE score above, you would calculate TEEP as follows:

TEEP (scheduled production as % of calendar time) =OEE x utilization)

OEE is useful in demonstrating how productive a manufacturing operation is while it's running, during scheduled working hours. TEEP takes things a step further and highlights the impact of scheduled downtime primarily the hours the factory is closed. It demonstrates the untapped potential in a manufacturing plant, or the "hidden factory, showing how much more capacity a manufacturer has available to increase production without spending a single dollar on new equipment or property.

How to use OEE and TEEP formulas

Using the OEE and TEEP calculations set out above, a typical factory with an OEE of 65% operating two standard shifts only on weekdays might have a TEEP of just 30%. Machinery not being utilized for two-thirds of the time represents a huge wasted opportunity. TEEP offers more than just a stark insight into the extent of untapped capacity in a manufacturing operation; it can help with business planning, providing an indication of sales capacity based on the full production capacity of the plant. TEEP is also useful for looking at the scheduling effectiveness of production lines, in particular, allowing manufacturers to model the impact of changes to opening times or shift patterns.

Self-Check – 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test I: Short Answer Questions

1. Write down the importance of identifying out of specification
2. List the factors affecting the quality of seams
3. What is Total effective equipment performance?
4. How is Total effective equipment performance?
5. What is out-of-specification?
6. What are the main stages to the seaming process?

Operation sheet 3

3.1.Operating Jam packaging process;

A. Materials, tools and equipment's required

- **PPEs;**
  - ✓ Gloves
  - ✓ Shoes
  - ✓ Face mask
  - ✓ Gown/Overall
- **Materials and tools;**
  - ✓ Tomato
  - ✓ Cartoon
  - ✓ Plastic
  - ✓ Cardboard
  - ✓ Glass
- **Packing machines;**
  - ✓ Conveyor
  - ✓ Filling machine
  - ✓ Sealing Machine
  - ✓ Lid Labelling machine
  - ✓ Coding machine
  - ✓ Cartooning material
  - ✓ Palletizer machine

B. Procedures

I. Wear appropriate personal protective equipment
II. Filling by using sealing machine.
III. Sealing by using automatic box sealing machine.
IV. Lid-labelling by using labelling machine.
V. Coding by using automatic inkjet coding machine.
VI. Cartooning by using a cartooning machine (cartoner).
VII. Palletize to pick the completed boxes up and put them down on the pellet for transportation using Palletizing machine.
VIII. Clean different dimensional machine parts used for packaging.

LAP Test-3	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 120 minutes. The project is expected from each student to do it.

Task-1: Perform Jam packaging

LG #26	LO#4-Shutdown the Cooling and Wrapping Process

Instruction sheet

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

- Identifying the appropriate shut down procedure.
- Shut down and cleaning the process.
- Identifying and Reporting Maintenance requirements.

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

- Identify the appropriate shutdown procedure is
- Clean the process is shut down and according to workplace procedures.
- Identify and report maintenance requirements according to workplace reporting requirements.

Learning Instructions:

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

Information sheet -4

4.1 Identifying the appropriate shut down procedure.

4.1.1 Procedure of shutdown

Shut down/isolation means and includes isolation of mechanical, electrical drives, pipework (pressure) rotating equipment etc. utilizing electrical lock-off isolators, mechanical and power driven valves etc. in accordance with standard operating instructions. Relevant regulations:

- Shutdown sequence is undertaken safely and to standard operating procedures.
- Machine/equipment is depressurized /emptied/de-energized/bled to standard operating procedures.
- Safe shutdown of machine/equipment is verified.
- Safety/security lock-off devices and signage are installed to standard operating procedures.
- Machine/equipment is left in clean and safe stat
- When working with tools at height makes sure they cannot fall
- Do not leave power tools switched on when disconnected from their power as unexpected starting will occur when power is re-connected.
- Ensure that cables, power lines, pipes and hoses are not allowed to trail across gangways or work areas
- Check insulation, switches and fuse boxes for possible hazards. Ensure warning signs are clear and easily seen.
- Ensure that correct type of firefighting equipment
- Remove empty cartons, wrappings and other flammable waste as soon as possible

4.2. Shut down and cleaning the process.

4.2.1Shut down process

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

Steps of shutting down process:

- Reading, interpreting and following information on written job instructions, specifications and other applicable reference documents.
- checking and clarifying task-related information
- Entering information onto preforms and standard workplace forms.
- Shutting down machine/equipment.
- Purging/de-energizing equipment.
- Installing safety/security lock-off devices and signage

Cleaning the work area according to housekeeping standards

- Housekeeping standard may include:
- Cleaning and sanitation procedures



Figure 4.1 Wapping apple

4.3 Identifying and Reporting Maintenance requirements.

Preventive maintenance includes measures such as systematic and routine cleaning, adjustment and replacement of equipment parts at scheduled intervals. Manufacturers generally recommend a set of equipment maintenance tasks that should be performed at regular intervals: daily, weekly, monthly or yearly. Following these recommendations will ensure that the equipment performs at maximum efficiency and will increase the lifespan of the equipment. In order to report faults and problems, there should be maintenance schedule. Every work shop has a different maintenance schedule and it is important that you are familiar with the schedule implemented on the work shop where you work. A maintenance schedule assigns a specific date to specific maintenance tasks.

Table 4.1 Documenting and report maintenance

S.No.	Date	Equipment	Maintenance Check points	Maintenance Required	Signature
1					
2					
3					

Self-check-4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test I: Short Answer Questions

1. List the Relevant regulations of shut down
2. Write type of maintenance?
3. What is shut down?

Operation Sheet -4

4.1 Shutting down mango powder automatic filler packaging machine safely;

A. Materials, tools and equipment;

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

- **Packaging machines:**
  - ✓ Mango powder automatic auger filler packaging machine

B. Procedures mango powder automatic filler packaging machine safely;

1. Wear appropriate personal protective equipment's.
2. Stop the machine by pressing button on the control panel, if packaging process has been done, or
3. Press the shutdown button on the control panel to turn off milk powder packaging machine.
4. Follow proper shutdown of manufacturing guide line or manual.
5. Clean the machine.



Single head powder filling machine, Automatic Auger Powder filling filler

https://www.youtube.com/shorts/XCIeyapyiuM(access date 22/01/2023)

LAP Test-4	**Performance Test**

Name: ……. ID: …….. Date: …….

Time started: _____ Time finished: _____

Instruction: Given necessary templates, tools and materials you are required to perform the following tasks within **2:30 hour**. The project is expected from each trainee to do it.

Task-1: Shutting down Automatic packaging machine safely.

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