Fruit and Vegetable Processing-Level-II

Based on May 2019, Version 2 Occupational standards

Module Title: - Performing Cooling and Wrapping Operation

LG Code: IND FVP2 M11 LO (1-4) LG (37-40)

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LG #37	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 product and packaging consumables
- Identifying and confirming cleaning and maintenance requirements and status
- Fitting and adjusting machine components and related attachments
- Entering processing/operating parameters
- 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
- Identify and confirm cleaning and maintenance requirements and status
- Fit and adjust machine components and related attachments
- Enter processing/operating parameters
- Check and adjust equipment performance
- Carry out pre-start checks

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information Sheet 1- Confirming product and packaging consumables

1.1. Introduction

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**. Fruits and vegetables** are nutritious, valuable foods full of flavour. However, in the low-income countries, poor care and handling of these crops frequently results in loss of quality, especially when not consumed immediately. Fruits and vegetables provide an abundant and inexpensive 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 promptly and properly preserved. While, Fruits and vegetables should be prepared for preservation as soon as possible after harvesting, in any case within 4 to 48 hours. The likelihood of spoilage increases rapidly as time passes.

Packaging is one of the most important processes without which nowadays products would not be finished. When the competition is high, like it is today, the products of rivalling companies become very similar in their functions. More often than ever before, customers pick the product not by their characteristics but by the characteristics of their package. Regulations on national and international levels determine the ways of usage of packaging. Food wrap is a thin plastic film typically used for sealing food items in containers to keep them fresh over a longer period.

What is shelf life?

Defined as the period within which the product retains 'acceptable quality' for sale to the processor or consumer

Appearance:

- ✓ key factor for consumers in making purchases of fresh produce
- ✓ Includes shape, size and color
- ✓ Factors reducing this quality:
    - Mechanical damage - browning reactions

- Diseases
- Loss of freshness – wilting of leafy vegetables
- Yellowing of green leafy vegetables

Quality factors for fruits include the following— maturity, firmness, the uniformity of size and shape, the absence of defects, skin and flesh color. Many of the same quality factors are described for vegetables, with the addition of texture-related attributes such as turgidity, toughness, and tenderness.

Fig 1.1. Different types of fruit and vegetable products

The **packing material** must be clean.

- **Generally, the material required for packing include:**
  - ✓ Materials transfer equipment, such as conveyors and trolleys
  - ✓ Cooler
  - ✓ Slicer
  - ✓ Bagging and bag closing equipment
  - ✓ Metal detector and scales

The more microorganisms that meet the food, the longer the heating process will have to take. On the other hands, the materials listed in the above expected to provide the following services, which should be confirmed, and it includes:

- ✓ Water
- ✓ Power
- ✓ Compressed and instrumentation air

1.2. Packing in the field and transport to packinghouse

Berries picked for the fresh market (except blueberries and cranberries) are often mechanically harvested and usually packed into shipping containers;

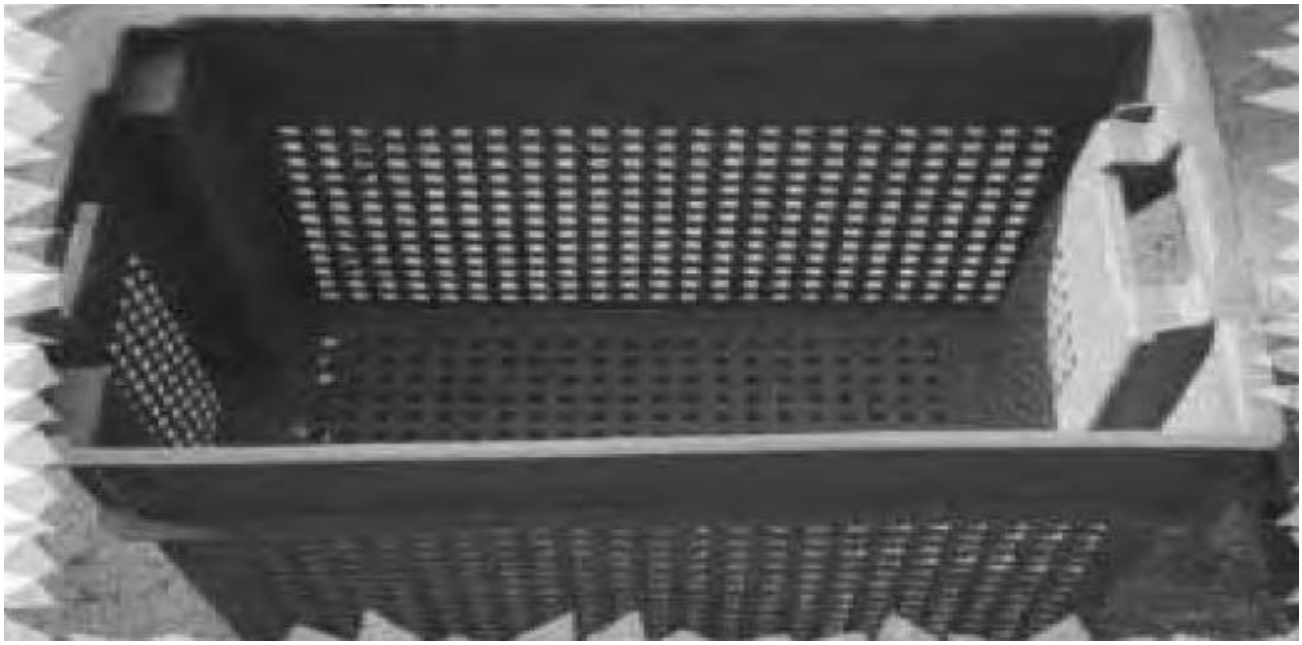
- ✓ Careful harvesting,
- ✓ Handling, and
- ✓ Transporting of fruits and vegetables to packinghouses are necessary to preserve product quality.

Polyethylene bags:

Clear polyethylene bags are used to pack banana bunches in the field, which are then transported to the packinghouse by means of mechanical cableways running through the banana plantation.

Plastic field boxes:

These types of boxes are usually made of polyvinyl chloride, polypropylene, or polyethylene. They are durable and can last many years.



Figu1.1.Plastic field boxes with nest/stack design.

Wooden field boxes:

These boxes are made of thin pieces of wood bound together with wire. They come in two sizes: the bushel box with a volume of 2200 in3 (36052 cm^3) and the half-bushel box. They are advantageous because they can be packed flat and are inexpensive, and thus could be nonreturnable.

Fig 1.2 Typical wooden crate holding fresh tomatoes

Fig 1.3 Agricultural apple baskets, pear and corncob carriers.

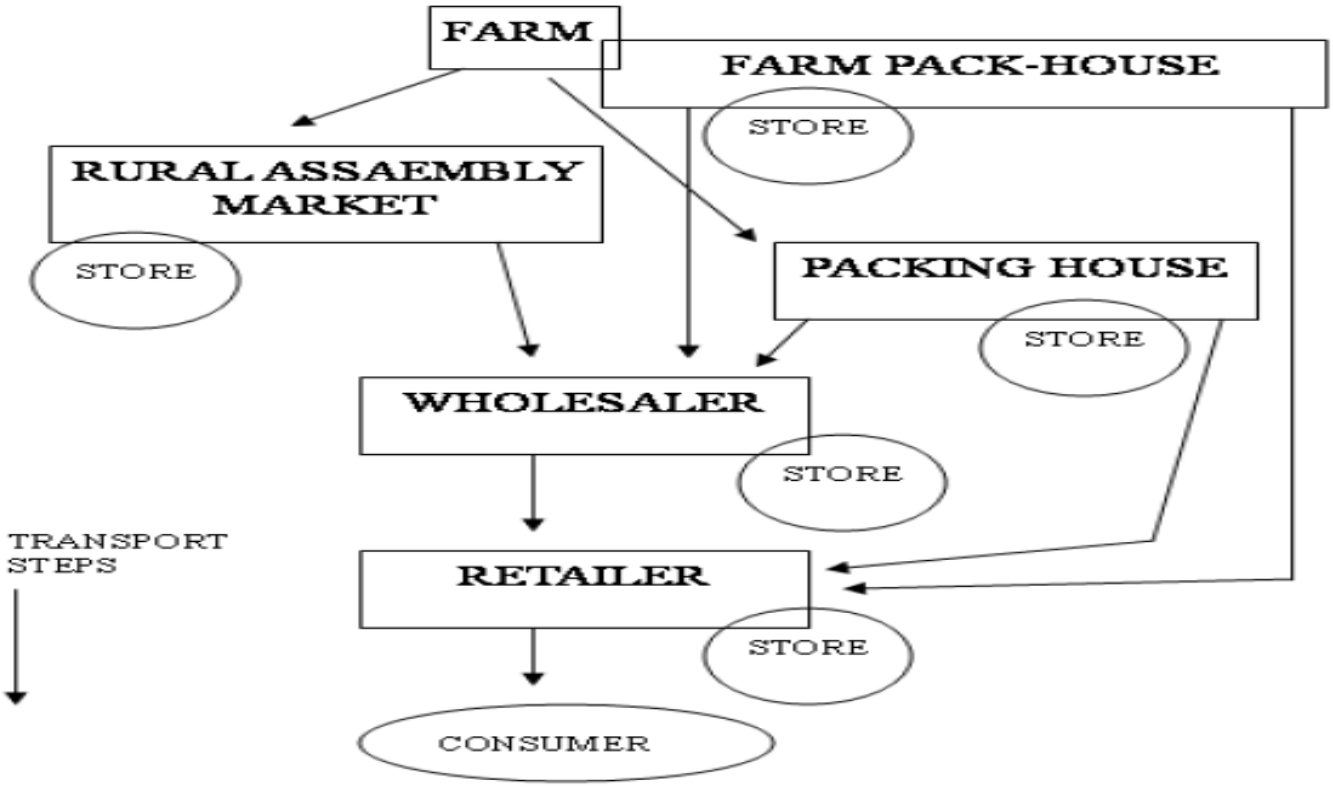


Fig 1.4 preparation process of fruit and vegetable for market

1.3. Cooling and packaging

- **Cooling and cold storage facilities:**
  - ✓ **Forced air-cooling is** the most versatile cooling method if the humidity of the air is above 95%. Hydro cooling is a faster cooling method, but not all commodity tolerant wetting. Waxed cartons must be used if the commodity is hydro cooled after packing.
  - ✓ **Cold storage rooms** should be adjacent to the cooling facility in order to facilitate transfer of the cooled commodity into the storage area and to prevent rewarming of the commodity before it is loaded into the transport vehicles.
- **The modern packaging must comply with the following requirements:**
  - ✓ The package must have sufficient mechanical strength to protect the contents during handling, transport, and stacking.
  - ✓ The packaging material must be free of chemical substances that could transfer to the produce and become toxic to man.
  - ✓ The package must meet handling and marketing requirements in terms of weight, size, and shape.
  - ✓ The package should allow rapid cooling of the contents. Furthermore, the permeability of plastic films to respiratory gases could also be important.
  - ✓ Mechanical strength of the package should be largely unaffected by moisture content (when wet) or high humidity conditions.

- ✓ The security of the package or ease of opening and closing might be important in some marketing situations.
- ✓ The package must either exclude light or be transparent.
- ✓ The package should be appropriate for retail presentations.
- ✓ The package should be designed for ease of disposal, re-use, or recycling.
- ✓ Cost of the package in relation to value and the extent of contents protection required should be as low as possible.

- **Packages can be classified as follows:**
  - ✓ Flexible sacks; made of plastic jute, such as bags (small sacks) and nets (made of open mesh)
  - ✓ Wooden crates
  - ✓ Cartons (fiberboard boxes)
  - ✓ Plastic crates
  - ✓ Pallet boxes and shipping containers
  - ✓ Baskets made of woven strips of leaves, bamboo, plastic, etc.

Self-check 1	Written test

Name…… ID…… Date…

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

Test I: Choose the best answer (4 point)

Test II: choose the correct answer

1. from the following, which is not the material required for packing

A. conveyors and trolleys
B. Cooler
C. Slicer
D. Bagging and bag closing equipment
E. Metal detector and scales
F. None

2. Packages include:

A. Flexible sacks
B. Wooden crates
C. Cartons (fiberboard boxes)
D. Plastic crates
E. Pallet boxes and shipping containers
F. All

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

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 4 points**

Information Sheet 2- Identifying and confirming cleaning and maintenance requirements and status

2.1. Operations prior to packaging

Fruits and vegetables are subjected to preliminary treatments designed to improve appearance and maintain quality. These preparatory treatments include cleaning, disinfection, waxing, and adding of colour (some includes brand name stamping on individual fruits). Specific information about the appropriate ways to prepare and preserve the various types of fruits and vegetables can be found includes the following activities:

- ✓ Pasteurization (heating up to 100°C) – for products that will be subsequently Stored at temperatures below 20°,
- ✓ Sterilization at 100°C – only for acidic products and
- ✓ Sterilization (above 100°C) in a pressure cooker or an autoclave

Cleaning:

Most produce receives various chemical treatments such as spraying of insecticides and Pesticides in the field. Most of these chemicals are poisonous to humans, even in small Concentrations. Therefore, all traces of chemicals must be removed from produce before packing.

As illustrated in Figure 1.5, the fruit or vegetable passes over rotary brushes where it is rotated and transported to the washing machine and exposed to the cleaning process from all sides:

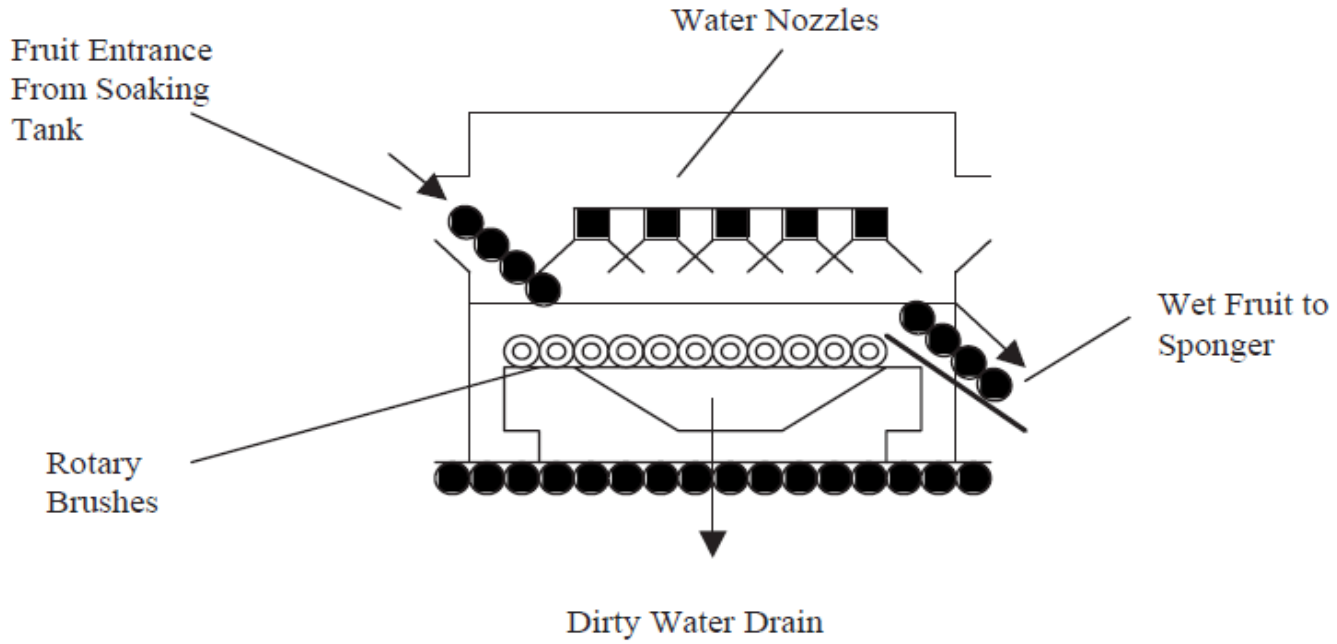


Figure 1.5 Typical produce washing machine.

From the washing machine, the fruit passes onto a set of rotary sponge rollers (similar to the Rotary brushes). The rotary sponges remove most of the water on the fruit as it is rotated and transported through the sponger.

Disinfection:

After washing **fruits and vegetables,** disinfectant agents are added to the soaking tank to avoid propagation of diseases among consecutive batches of produce. In a soaking tank, a typical solution for citrus fruit includes a mixture of various chemicals at specific concentration, pH, and temperature, as well as detergents and water softeners. Sodiumortho- phenyl-phenate (SOPP) is an effective citrus disinfectant, but requires precise control of conditions in the tank. Concentrations must be kept between 0.05 and 0.15%, with pH at 11.8 and temperature in the range of 43-48°C. Recommended soaking time is 3-5 minutes.

Artificial waxing:

Artificial wax is applied to produce to replace the natural wax lost during washing of fruits or Vegetables. This adds a bright sheen to the product. The function of artificial waxing of produce is summarized below:

- ✓ Provides a protective coating over entire surface.
- ✓ Seals small cracks and dents in the rind or skin.
- ✓ Seals off stem scars or base of petiole.
- ✓ Reduces moisture loss.
- ✓ Permits natural respiration.
- ✓ Extends shelf life.
- ✓ Enhances sales appeal.

Brand name application:

Some distributors use ink or stickers to stamp a brand name or logo on each individual fruit. Ink is not permissible in some countries (e.g., Japan), but stickers are acceptable.

Self-Check – 2	Written test

Name…… ID…… Date…

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

Test I: Short Answer Questions (5 pts)

1. List the specific information about the appropriate ways to prepare and preserve the various types of fruits and vegetables;----------
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You can ask you teacher for the copy of the correct answers.

Note: **Satisfactory rating – 2.5 points** **Unsatisfactory - below 2.5 points**

Information Sheet 3- Fitting and adjusting machine components and related attachments

3.1. Fitting and adjusting machine components

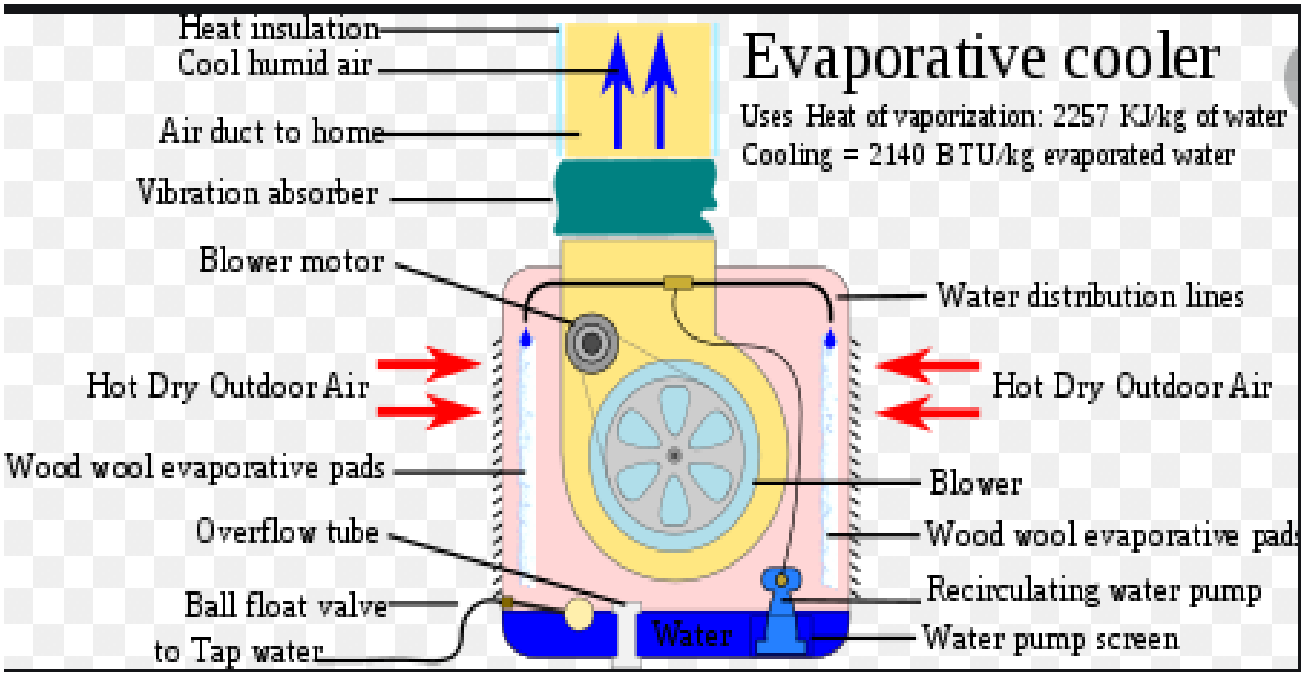
The major components of the cooling system are the water pump, freeze plugs, the thermostat, and the radiator, cooling fans, the heater core, the pressure cap, the overflow tank and the hoses. To understand how the cooler works and what it does, it is first necessary to trace the path of the liquid mixture through the cooler valve. The adjustment of cooler machine include; first, it removes excess heat from the engine; second, it maintains the engine operating temperature where it works most efficiently; and finally, it brings the engine up to the right operating temperature as quickly as possible.

Parts of the Cooling System

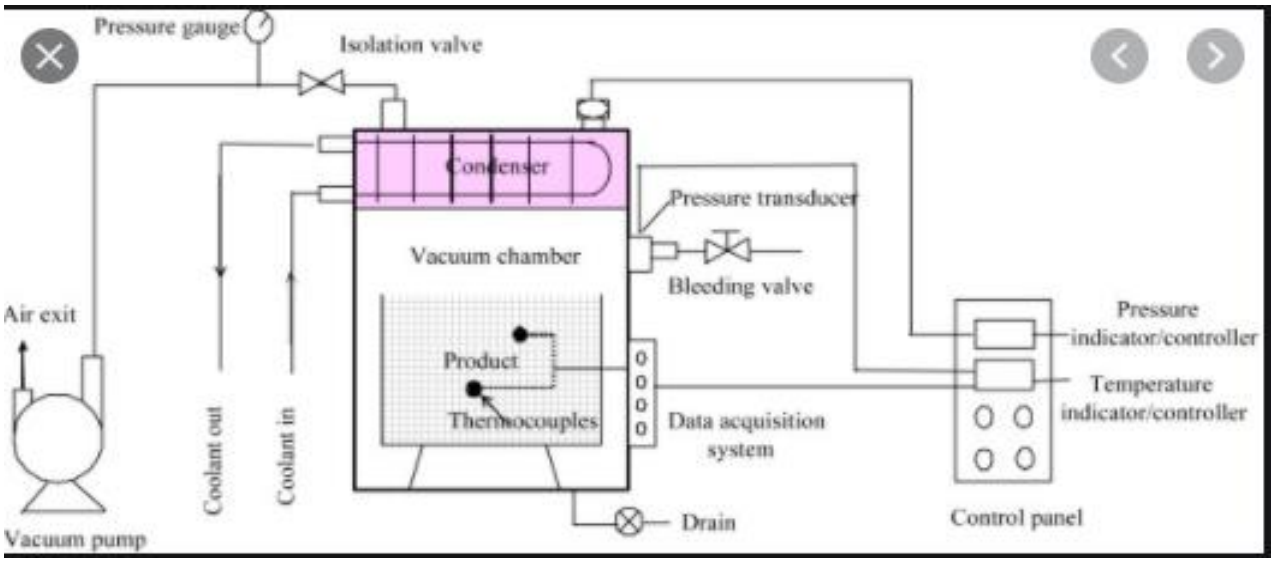
- Cooling Fan. The cooling fan is located at the very front of the vehicle and is designed to turn on when the coolant (we'll talk more about this in a minute) begins to get to hot. ...
- Radiator.
- Water Pump.
- Thermostat.
- Hoses.
- Antifreeze/Coolant.

Types of cooler

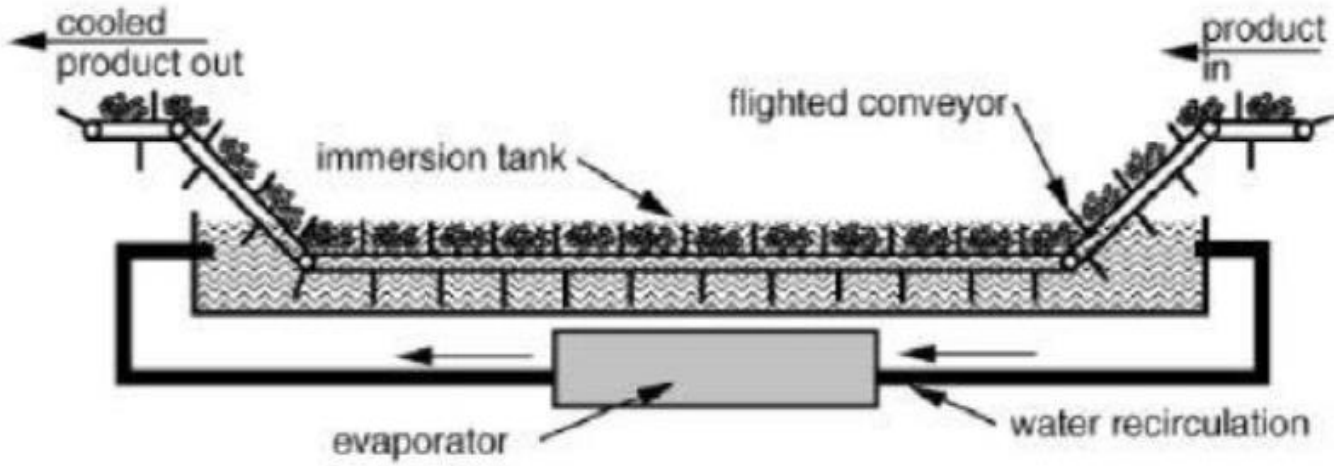
Forced air cooler of vegetable



Evaporative cooler and its parts



Vacuum cooler components



Hydro cooler and components

Self-Check – 3	**Written test**

Name…… ID…… Date…

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

Test I: Short Answer Questions (6 pts)

1. List the components of hydro cooler and vacuum cooler:----------
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You can ask you teacher for the copy of the correct answers.

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

Information Sheet 4- Entering processing/operating parameters

4.1. Requirement of cooling and wrapping

The **cooling of fruits and vegetables** in hydrocooling 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. Fruits (orange melon Cucumis melo, mango-Mangifera indica, guava-Psidium guajava, orange-Citrus sinensis Osbeck, plum Prunus domestica, lime-Citrus limon, and acerola-Prunus cerasus) and vegetables (cucumber-Cucumis sativus, carrot-Daucus carota, and green bean-Phaseolus vulgaris), were cooled in a hydrocooling system at 1ºC. 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.

Cooling: 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. In case of canned vegetables, cooling is done by turning in cold water into pressure cooker. Processing time and temperature should be adequate to eliminate all bacteria and to minimize quality damage. Fruits and vegetables processed at temperature of 100˚C as presence of acid retards the bacteria and their spores. Non-acid vegetables are processed at high temperature 115-121˚C. Temperature and processing time vary with size of can and nature of food. Temperature at the centre of can, should be maintained for long period to ensure the destruction of most heat resistant bacteria.

Selection of fruits and vegetables:

Fruits and vegetables selected for canning should be fresh. Fruits used for canning should be ripe, firm and evenly matured, and vegetables should be tender. Fruits and vegetables should be stored at cool place and free from dirt, mechanical injury and insect damage.

Sorting and grading:

Sorting for same kind of items is done by passing through series of moving screens. After sorting fruits and vegetables are graded for uniform quality of size and color. Different types of

grading machines are used such as screen grader, roller grader, rope and cable grader. Hand picking methods is generally used for soft fruits and berries.

Washing:

Fruits and vegetables are washed through high-pressure sprays, steam, by soaking or agitating in water. Vegetables soaked in a dilute solution of potassium permanganate and root crops soaked in chlorine water (25-50 ppm).

Peeling, Coring and Cutting

Types of peeling:

- ✓ Hand peeling,
- ✓ Heat peeling,
- ✓ Steam peeling,
- ✓ Mechanical peeling and
- ✓ Lye peeling methods are used.

Hand peeling is done in case of irregular shape fruits and vegetables.

Heat peeling, fruits and vegetables are exposed to a high temperature of 40˚C for 10-60 seconds.

Steam peeling, steam is used to loosen the skin, which is then removed by mechanical means. Fruit are immersed in 1- 2% **lye** solution for 30 seconds to 2 minutes in lye peeling.

Mechanical peeling is done in case of fruits like peaches, apricots, sweet orange and vegetables like carrot, sweet potatoes.

Coring is the process of removing centre of various fruits and vegetables such as:

Apple,

Pears,

Pineapple,

Lettuce and

Cabbage, done by a hydraulic powered device with turbine wheels.

A special blade mounted on the turbine wheel spins and removes the core. Cutting is done according to the requirement of process.

Blanching: is done by dipping fruits and vegetables in hot water at temperature 82-90˚ C for 2-5 minutes and then immediately cooled by immersion in cold water. Main Objective of blanching is to inactivate the enzyme, to soften the texture, to loosen skin, to reduce the number of microorganism, to enhance the green color of vegetables, to remove acid and astringent taste. Hard water cause toughening of tissue and destroys the natural texture, so it should be avoided.

Cooling: To keep fruits and vegetable into good condition, cooling is done after blanching

Precooling:

The temperature of fruit and vegetables at harvest is close to that of ambient air and could be as high as 40^0C. While, at this temperature respiration rate is extremely high storage life is short (It is advised to harvest early in morning as the lower temperature prevails at that time) and rapid cooling after harvest is generally referred to as precooling. Additionally, it removes the field heat, includes any cooling treatment given to produce before shipment, storage or processing and done within 24 hours after harvest.

The selection of the precooling method depends on three main factors:

- ✓ The temperature of the produce at harvest
- ✓ The physiology of the produce
- ✓ The desired post-harvest life

Methods of precooling:

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

Forced air (pressure) cooling:

- ✓ 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

Hydro cooling:

- ✓ is a rapid method for cooling in which water acts as the heat transfer medium
- ✓ is maintained as close to 0^0C as possible; moving conveyor
- ✓ hydro cooling may also clean the produce
- ✓ but chances of contamination of the produces with spoilage mo_s

Contact Icing:

- ✓ used especially for highly perishable commodities such as leafy vegetables
- ✓ 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

Vacuum cooling:

- ✓ mostly used for the vegetables that have a high surface to volume ratio such as leafy vegetables
- ✓ boiling off some of their water content i.e. moisture at low pressure
- ✓ the pressure is reduced to about 660 Pascals (5mm mercury) At this pressure water boils at 1^0C and the produce is cooled by evaporation of water from the tissue surface
- ✓ Leafy vegetables are ideally suited to vacuum cooling
  - Asparagus, broccoli, Brussels sprout, mushroom & celery can be vacuum cooled.
  - Fruits are having a low surface to volume ratio and a waxy cuticle, so loss of water is slow and do not benefit vacuum cooling.

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

Self-check 4	Written test

Name…… ID…… Date…

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

Test I: say true or false

1. Fruits used for canning should be ripe, firm and evenly matured, and vegetables should be tender.
2. Fruits and vegetables should be stored at cool place and free from dirt, mechanical injury and insect damage.

Answer Sheet

Score = _____

Rating: _____

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

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

Information Sheet 5- Checking and adjusting equipment performance

5.1. Introduction.

Measuring the normality of equipment like; cooler and PPE, material like; water, ice, waxes and tools by performance monitoring has the potential to give warning of a developing failure through the changing levels of a suitable parameter being measured, thereby indicating a change in condition of a component, machine or system. The core activity required in this context include; equipment performance monitoring, equipment condition assessment and equipment health monitoring. Whereas, the monitoring and process Analysis include the following condition of equipment**:**

- ✓ Availability
- ✓ Capacity
- ✓ Quality
- ✓ Safety
- ✓ Risk and cost can be continually evaluated throughout an asset's lifetime

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

Checking Equipment Performance

Equipment performance monitoring surveys may be required on a routine basis include the following items:

Poor operational practice:

Is also one of the main causes of problems on treatment plants. It is imperative that operators understand why they are performing certain tasks and what the consequences are if the tasks are not carried out as prescribed. It is the responsibility of a treatment plant manager to ensure appropriate training of the operating staff

Lack of maintenance is the most common reason for plant failure. Mechanical equipment requires regular attention to ensure problem-free operation. Maintenance schedules must be strictly carried

out. Good housekeeping and keeping equipment, buildings and civil structure clean and tidy go a long way to minimize operational problems. Work area, materials, and equipment are routinely monitored to ensure compliance with purification requirements.

Additionally, checking condition of equipment include:

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. Before they are to be stowed or kept after use, they must be inspected and checked to make sure they are in good condition and ready for use in the next processing operation. Inspecting and checking the equipment after use will help determine the presence of damaged or defective parts that need to be replaced.

- Inspecting and checking the equipment before, during and after using them will also help in effectively planning and efficiently carrying out trouble shooting and preventive maintenance activities which include checking the following:

  - ✓ **Machine temperature** – this is checked to avoid overheating
  - ✓ **Check surface condition**– this is being checked to make sure no machine parts are deteriorating or defective due to everyday use
  - ✓ **Leak detection**–this is checked to prevent accidental release of gas, water, oil, etc. from the machine.
  - ✓ **Corrosion**–this is checked to minimize wear and tear of parts by washing, drying and lubricating machine parts.

Self-check 5	Written test

Name…… ID…… Date…

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

Test I: say true or false (5 point)

1. Inspecting and checking the equipment before, during and after using them will also help in effectively planning and efficiently carrying out trouble shooting and preventive maintenance activities.

Answer Sheet

Score = _____

Rating: _____

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

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

Information Sheet 6- Carrying out pre-start checks

6.1. Checking equipment of cooling and wrapping

Before any equipment or machine is used, it must first be checked to make sure that it is very functional and in good condition. Checking and inspecting equipment and machines will guarantee that all their parts are intact and that no part is missing or defective. This will also assure that electrical plugs and wirings are not defective and will not in any way cause problems on short circuits, electrocution or any form of accident. Performing pre- operation activities ensures that all the tools, equipment and utensils assembled, checked, inspected, sanitized, readied and stowed after use are the appropriate devices required in processing the food based on the method of processing that will be undertaken like pickling, canning, bottling, processing using sugar.

Conduct Checks on Machine/Equipment

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

- ✓ Check that it is complete, with all safeguards fitted, and free from defects.

The term 'safeguard' includes guards, interlocks, two-hand controls, light guards, pressure-sensitive mats etc. By law, the supplier must provide the right safeguards and inform buyers of any risks ('residual risks') that users need to be aware of and manage because they could not be designed out.

- ✓ Produce a safe system of work for using and maintaining the machine.

Maintenance may require the inspection of critical features where deterioration would cause a risk Also look at the residual risks identified by the manufacturer in the information/instructions provided with the machine and make sure they are included in the safe system of work.

- ✓ Ensure every static machine has been installed properly and is stable (usually fixed down) and is not in a location where other workers, customers or visitors may be exposed to risk.
- ✓ Choose the right machine for the job.

Make sure the machine/ equipment is:

- ✓ safe for any work that has to be done when setting up, during normal use, when clearing blockages, when carrying out repairs for breakdowns, and during planned maintenance;
- ✓ Properly switched off, isolated or locked-off before taking any action to remove blockages, clean or adjust the machine.

Also, make sure you identify and deal with the risks from:

- ✓ Electrical, hydraulic or pneumatic power supplies;
- ✓ Badly designed safeguards. These may be inconvenient to use or easily overridden, which could encourage your workers to risk injury and break the law. If they are, find out why they are doing it and take appropriate action to deal with the reasons/causes.

The reason for conducting pre-operational and regular checks is to reduce the potential for time out of the paddock due to maintenance issues, and to ensure the spray system is working correctly and efficiently. Good maintenance and regular checks can help to resolve minor problems before they lead to the need for major repairs. Unexpected downtime at critical periods in the season can be especially frustrating when conditions are good for spraying. The operator should check on a regular basis many things. Some of these will be quick checks while spraying, others may be at the end of the tank or the end of a day is spraying. The most important of all checks the operator can do is when the sprayer is first delivered.

Self-check 6	Written test

Name…… ID…… Date…

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

Test I: Give short answer (5 point)

1. List the condition should be checked before start using any machine:----------
   ----

Answer Sheet

Score = _____

Rating: _____

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

Note: **Satisfactory rating -2. 5 points** **Unsatisfactory – below2. 5points**

LG #38	LO #2- Operate 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 cooling and wrapping process
- Monitoring equipment.
- Identifying variation in equipment operation on control panel board
- Reporting maintenance requirements
- Monitoring cooling and packaging process
- Identifying and reporting out-of-specification product/process and outcomes
- Maintaining work area.
- Conducting work
- Maintaining workplace records

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

- Start and operate cooling and wrapping process
- Monitor equipment.
- Identify variation in equipment operation on control panel board
- Report maintenance requirements
- Monitor cooling and packaging process
- Identify and report out-of-specification product/process and outcomes
- Conducting work and maintaining work area.
- Maintaining workplace records

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Information Sheet 1- Starting and operating cooling and wrapping process

1.1. Preparation for cooling and wrapping

Fruits and vegetables are plant-derived products, which can be consumed, in its raw form without undergoing processing or conversion. Fresh-cut fruits and vegetables (FFV) are products that have been cleaned, peeled, sliced, cubed or prepared for convenience or ready-to-eat consumption but remains in a living and respiring physiological condition. Methods of preserving FFV to retain its wholesomeness includes washing with hypochlorite, hydrogen peroxide, organic acids, warm water and ozone for disinfestation and sanitization; use of antimicrobial edible films and coatings; and controlled atmosphere storage and modified atmosphere **packaging of fruits and vegetables**.

- **Packaging Containers**
  - ✓ Containers must be food grade quality.

✓ Must protect integrity of the product and disposable containers should not be re-used.

Fig 1.1 packaging container

Cooling the Product

To prolong the shelf life of a product, it is important to cooling it down to slow respiration. The importance and optimum storage temperature varies with; the respiration rate of the product and whether the product is chilling sensitive.

- ✓ Wet product can allow rapid bacterial growth if not cooled.
- ✓ Proper storage temperature is dependent upon the vegetable or fruit.
- ✓ Critical temperatures are
- ✓ Below 41°F to minimize bacterial growth.
- ✓ Bacterial grow most rapidly from 70 - 135°F.

Cooling Principle of Half Cooling Time for standard coolers with moderate air circulation:

In cooling a product from its initial temperature to the desired storage room temperature.

– If it take X hours to cool the product temperature to 1/2 the storage room temperature, then it will take:

– 2X hours to cool it to 3/4 the storage room temp.

– 3X hours to cool it to 7/8 the storage room temp.

– 4X hours to cool it to 15/16 the storage room temp.

1.2. Cooling methods and temperatures

Several methods of cooling are applied to produce after harvesting to extend shelf life and maintain a fresh-like quality. Some of the low temperature treatments are unsuitable for simple rural or village treatment but are included for consideration as follows:

- ✓ **Precooling**

Fruit is precooled when its temperature is reduced from 3 to 6°C (5 to 10°F) and is cool enough for safe transport. Precooling may be done with cold air, cold water (hydrocooling), direct contact with ice, or by evaporation of water from the product under a partial vacuum (vacuum cooling). A combination of cooled air and water in the form of a mist called hyraircooling is an innovation in cooling of vegetables.

- ✓ **Air precooling**

Precooling of fruits with cold air is the most common practice. It can be done in refrigerator cars, storage rooms, tunnels, or forced air-coolers (air is forced to pass through the container via baffles and pressure differences).

- ✓ **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.

- ✓ **Room cooling**

This method involves placing the crop in cold storage. The type of room used may vary, but generally consists of a refrigeration unit in which cold air is passed through a fan. The circulation may be such that air is blown across the top of the room and falls through the crop by convection. The main advantage is cost because no specific facility is required.

- ✓ **Forced air-cooling**

The principle behind this type of precooling is to place the crop 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.

- ✓ **Hydrocooling**

The transmission of heat from a solid to a liquid is faster than the transmission of heat from a solid to a gas. Therefore, cooling of crops with cooled water can occur quickly and results in zero loss of weight. To achieve high performance, the crop is submerged in cold water, which is constantly circulated through a heat exchanger. When crops are transported around the packhouse in water, the transport can incorporate a hydro cooler. This system has the advantage wherein the speed of the conveyer can be adjusted to the time required to cool the produce. Hydrocooling has a further advantage over other precooling methods in that it can help clean the produce. Chlorinated water can be used to avoid spoilage of the crop. Hydrocooling is commonly used for vegetables, such as asparagus, celery, sweet corn, radishes, and carrots, but it is seldom used for fruits.

- ✓ **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. For every 5 or 6°C reduction in temperature, under these

conditions, the crop loses about 1% of its weight (Barger, 1961). This weight loss may be minimized by spraying the produce with water either before enclosing it in the vacuum chamber or towards the end of the vacuum cooling operation (hydro vacuum cooling). The speed and effectiveness of cooling is related to the ratio between the mass of the crop and its surface area. This method is particularly suitable for leaf crops such as lettuce. Crops like tomatoes having a relatively thick wax cuticle are not suitable for vacuum cooling.

Steps to assistance in cooling:

- ✓ Harvest in the morning when it is cool.
- ✓ Keep the product out of direct sunlight.
- ✓ Move the product to the processing facility as soon as possible.
- ✓ Use water rinses in postharvest handling.
- ✓ Move product into a cooler as soon as possible after processing.
- ✓ Procedures to increase the rate of cooling:

  Forced air-cooling (within the storage room),

  Hydro cooling and

  Icing

Fruit and vegetable for Hydro cooling

When warm produce is cooled directly by chilled water, the process is known as hydrocooling. Hydrocooling is an especially fast and effective way to cool produce. With modern technology, hydrocooling has now become a convenient and attractive method of postharvest cooling on a large scale. In addition, hydro cooling is the process or technique of arresting the ripening of fruits and vegetables after harvesting by immersion in ice or cold water. 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.
- ✓ Strict maintenance of the cool chain (wet produce deteriorates faster at high temperatures).

The most important thing to remember about cooling foods is that the temperature of all cooked foods should be reduced to 41°F or colder as quickly as possible. Simply placing a cooked food item in a refrigerator to cool may not be sufficient to reduce the threat of bacterial growth. It is necessary to use a food thermometer to take temperatures regularly as the food cools and to take steps to speed up the process if the food is not cooling quickly enough. It is recommended that a cooling log be kept to track the cooling food temperatures, regardless of the cooling method used. Once the food item has been properly cooled, it should be stored properly – covered and labeled with the preparation date and the discard date of the food.

Process of Canning:

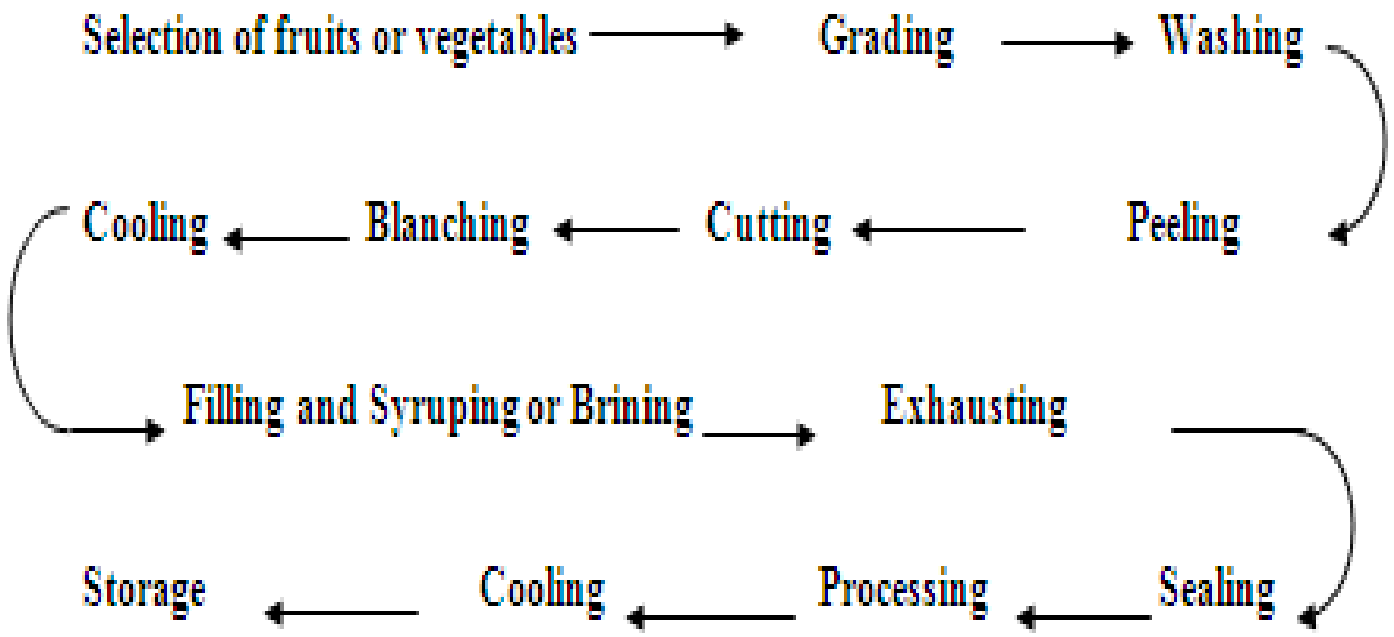

Fig 1.1 general process of canning fruit and vegetable

Self-Check – 1	Written test

Name…… ID…… Date…

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

Test I: Short Answer Questions (5 pts)

1. List the types of cooling;----------

   ----
2. Write down the steps of cooling:----------

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

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

Answer Sheet

Score = _____

Rating: _____

Information Sheet 2- Monitoring equipment

2.1 Monitor equipment

Monitoring is the systematic process of collecting, analyzing and using information to track a programmer's progress toward reaching its objectives and to guide management decisions during homogenization. An essential part of any environmental monitoring or measurement project is the equipment used. 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. Measuring machinery health by performance monitoring has the potential to give warning of a developing failure through the changing levels of a suitable parameter being measured, thereby indicating a change in condition of a component, machine or system. 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

Self-Check – 2	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions (5 pts)

1. Define the importance of monitoring equipment:----------

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

Note: **Satisfactory rating – 2.5 points** **Unsatisfactory – 2.5 below 3 points**

.

Answer Sheet

Score = _____

Rating: _____

Information Sheet -3 Identifying variation in equipment operation on control panel board

3.1 Identifying equipment operation

Cooling is done either by dipping or immersing can in cold water tank or by spraying jet of cold water. In case of canned vegetables, cooling is done by turning in cold water into pressure cooker. The required cooling time varies mainly with the temperature of cooling water, the dimensions of the container, and the characteristics of food in the container. While, **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.

Techniques of identifying equipment variations.

- Record and/or report faults and any identified causes to the supervisor concerned, where required, in accordance with workplace procedures

Assess quality of received components, parts or materials.

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

Self-check 3	Written test

Name…… ID…… Date…

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

Test I: Choose the best answer (5 point)

1. Explain how we can operating cooling;----------

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

Answer Sheet

Score = _____

Rating: _____

Note: **Satisfactory rating -2.5 points** **Unsatisfactory – 2.5 below 5points**

Information Sheet-4 Reporting maintenance requirements

4.1. Report maintenance requirement

Maintenance is working on something to keep it in a functioning and safe state and preserving it from failure or decline. Maintenance procedures are written instructions that, when followed by the maintenance personnel, will ensure that equipment operates as designed within safe operating limits. Based on the performance variation cooling and wrapping equipment maintenance activity can be recommend for improving the equipment performance. Whereas, maintenance of a cooling and wrapping equipment should be carried out on a regular basis. It has a vital role to play in reducing the risk associated with some workplace hazards and providing safer and healthier working conditions.

Insufficient/inadequate maintenance can cause serious (and potentially deadly) accidents or health problems. Cooler maintenance is the work that keeps mechanical assets running with minimal downtime. While this cooler maintenance activities can include regularly scheduled service, routine checks, and both scheduled and emergency repairs. It also includes replacement or realignment of parts that are worn, damaged, or misaligned. In generally, there are, four types of equipment maintenance: corrective, preventive, risk-based and condition-based maintenance.

The main purpose of regular maintenance is:

- ✓ To ensure that all equipment required for production is operating at 100% efficiency at all times.
- ✓ Through short daily inspections, cleaning, lubricating, and making minor adjustments, minor problems can be detected and corrected before they become a major problem that can shut down a production line.

A good maintenance program requires company-wide participation and support by everyone ranging from the top executive to the shop floor personnel. Equipment manufacturers' maintenance instructions must be followed as a minimum requirement. Ideally, maintenance requirements should reflect the raw water quality and flow, but this is often not the case and instructions may be vague.

- **Steps to Create a Maintenance Report in MS Word**

✓ Create the Cover Page. Open a new document in MS Word and write the title.

✓ Cover Letter. On the next page, include the cover letter.

✓ Device Information.

- ✓ New Parts Cost Details, suggestions and Signature.

Self-check 4	Written test

Name…… ID…… Date…

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

Test I: Choose the best answer (5 point)

1. Define monitor
2. List the way used to write report

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

Answer Sheet

Score = _____

Rating: _____

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

Information Sheet 5- Monitoring cooling and packaging process

5.1. Monitor cooling and packaging process

Monitoring is the collection and analysis of information about a process, undertaken while the process is ongoing in correct ways. Evaluation is the periodic, retrospective assessment of an organization, project or programme that might be conducted internally or by external independent evaluators. The canned products sterilized in a conventional retort can be cooled either at or above atmospheric pressure, or precooled above atmospheric pressure and then after-cooled at atmospheric pressure. 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.

The precooling of retort pouches and large containers has to be done with a constantly monitored overpressure for preventing container deformation due to rapid pressure drops in the retort. 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. The overpressure in pressure cooling or pressure precooling may be stablished by injecting steam or compressed air to superimpose over cooling water and submerged containers in the retort.

The amount of processing varies from food to food

Table 5.1 variation of food in their processing

Minimal processed	Moderately processed	Highly processed
Foods those are: washed, peeled, sliced, juiced, frozen, dried, or pasteurized.	In addition to being washed, peeled, sliced, etc. these foods may also be cooked, ingredients mixed, and some preservatives added.	Many ingredients are added to enhance flavor, add vitamins and minerals, and extend shelf life. These foods are mostly or fully prepared for eating.

Packaging Requirements for fresh fruits and vegetables

Packing and packaging materials contribute a significant cost to the produce industry; therefore, it is important that packers, shippers, buyers, and consumers have a clear understanding of the wide range of packaging options available.

The Function of Packaging

Containment

The container must enclose the produce in convenient units for handling and distribution. The produce should fit well inside the container, with little wasted space.

Protection

The package must protect the produce from mechanical damage and poor environmental conditions during handling and distribution.

Identification

The package must identify and provide useful information about the produce. It is customary (and may be required in some cases) to provide information such as the produce name, brand, size, grade, variety, net weight, count, grower, shipper, and country of origin.

Types of Packaging Materials

- Wood, rigid Plastic Packages and Carton

5.1. Wood packaging

- ✓ **Pulp Containers.** Containers made from recycled paper pulp and a starch binder are mainly used for small consumer packages of fresh produce
- ✓ **Paper and Mesh Bags.** Consumer packs of potatoes and onions are about the only produce items now packed in paper bags.
- ✓ **Plastic Bags.** Plastic bags (polyethylene film) are the predominant material for fruit and vegetable consumer packaging.
- ✓ **Shrink Wrap.** One of the newest trends in produce packaging is the shrink-wrapping of individual produce items.

Fig 5.2.Rigid Plastic Packages and Carton

Cold storage

Fig 5.3 cooled storing room

Monitoring and evaluation are ways of systematically measuring and assessing programme activities and results. Their purpose is to check on the progress of implementation and outputs systematically. They help to determine when a programme is going to plan and when changes may be needed.

Self-check 5	Written test

Name…… ID…… Date…

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

Test I: Choose the best answer (5 point)

1. Write down the purpose of packaging----------
   ----
2. List the material of packaging:----------

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

Answer Sheet

Score = _____

Rating: _____

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

Information Sheet 6 Identifying and reporting out-of-specification product/process and outcomes

6.1. Identify out-of-specification product/process and outcomes

Specification can be defined as a 'statement of needs'. It describes what the customer wants to buy and consequently, what the successful supplier is required to supply. Specifications can be simple or complex depending on the need. The success of the procurement outcome often relies on the Specification being a true and accurate statement of the buyer's requirements. Apart from being a means of identifying the goods / services required, a Specification will form part of any future contract that might result from offers received.

The term **OOS** (out of specification), is defined as those results of in process or finished product testing, which falling out of specified limits, that are mentioned in compendia, drug master file, or drug application. The out of specifications (OOS), may arise due to deviations in product manufacturing process, errors in testing procedure, or due to malfunctioning of analytical equipment. When an out of specifications (OOS) has arrived, a root cause analysis has to be performed to investigate the cause for OOS. The reasons for OOS can be classified as assignable and non-assignable. When the limits are not in specified limits called out of specifications. When OOS has occurred, the analyst should inform to quality control (QC) manager. Each out of specification will be identified with a unique identification number. In general, the temperature (39^{o}c), time and quality of product should be in range for each fruit and vegetables cooling process.

The OOS investigation should be thorough, timely, unbiased, well documented and scientifically sound.

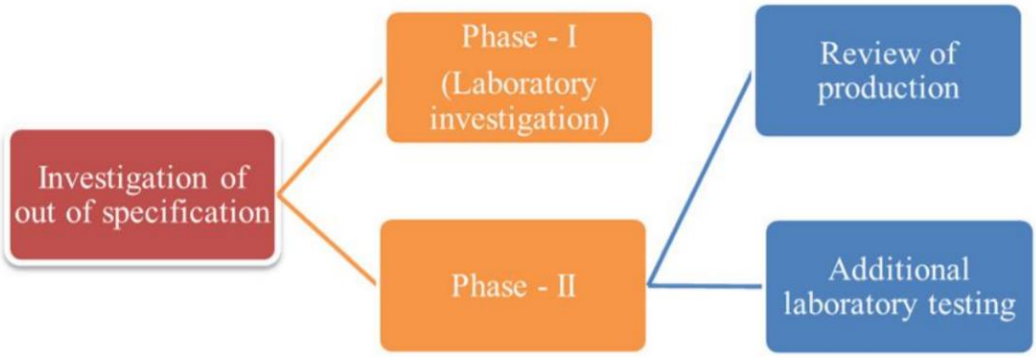

Figure 6.1. Analysis of out of specification result

Self-check 6	**Written test**

Name…… ID…… Date…

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

Test I: Choose the best answer (5 point)

1. What is out of specification?

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

Answer Sheet

Score = _____

Rating: _____

Information Sheet 7- Maintaining work area.

Note: Satisfactory rating -2. 5 points Unsatisfactory - below 2.5points

7.1. Importance of maintaining work area

Industrial good housekeeping is a term, which is often not fully understood. However most be good housekeeping is just good common sense. Everyone is responsible for safety and means that all management and every employee should have an understanding of good housekeeping practice, and how it can help to prevent a large number of accidents at work.

Good housekeeping involves the maintenance of good lighting and heating, power supply lines, tools, machinery and the facilities for the efficient storage of materials and equipment. Removing of any loses items, particularly when working at height or on grating should be a permanent concern. It also means maintaining the necessary standards of domestic cleanliness and tidiness to provide safe, healthy and pleasant places in which to work and live. Among the from benefits to be derived good housekeeping are:

- ✓ Increased efficiency.
- ✓ The reduction of accident hazards.
- ✓ The reduction of fire hazards.
- ✓ Improved morale.
- ✓ Compliance with the law.
- ✓ Creating a favorable impression to people outside the Company.

Workshop should be kept neat and tidy. Good housekeeping can significantly reduce the risk of an accident and injury, failure to maintain a clean and tidy Workshop can result in accident and injury. Work areas and equipment are to be thoroughly cleaned after use.

Generally, working environment is a broad term and means all your surroundings when working. Your physical working environment is, for example, your work tools as well as air, noise and light.

However, your working environment also includes the psychological aspects of how your work is organized and your wellbeing at work.

Self-check 7	Written test

Name…… ID…… Date…

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

Test I: Choose the best answer (5 point)

1. List the importance of monitoring work area:----------

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

Answer Sheet

Score = _____

Rating: _____

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

Information Sheet 8- Conducting work

8.1. Cooling and packaging

After blanching, the vegetables are dipped in cold water for better handling and keeping them in good condition. The cooling of fruits and vegetables in hydrocooling system can be a suitable technique, which is 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. Fruits (orange melon cucumis melo, mango-Mangifera indica, guava-Psidium guajava, orange-Citrus sinensis Osbeck, plum prunus domestica, lime-Citrus Limon, and acerola-Prunus cerasus) and vegetables (cucumber-Cucumis sativus, carrot-Daucus carota, and green bean-Phaseolus vulgaris), were cooled in a hydrocooling system at 1 ºC.

- **Fresh-cut products are fruits or vegetables** that have been trimmed, peeled and/or cut into a fully usable product, which is subsequently packaged to offer consumers high nutrition, convenience and flavour while maintaining freshness. The market for chilled fresh-cut produce has witnessed dramatic growth in recent years, stimulated largely by consumer demand for fresh, healthy, convenient and additive-free foods that are safe and nutritious. Packaging fresh fruits and vegetables is one of the more important steps in the long and complicated journey from grower to consumer.

Fresh-cut Physiology and Physiological Concerns:

Fresh-cut fruit and vegetables (FCFV) consumption has increased significantly in recent years. Because of the changes in consumer lifestyles, there is an increased demand of fresh-cut foods, which are nutritious, functional, safe, attractive, and ready-to-eat. The consumers perceive these products as the most appealing, considering their attributes, such as fresh-like appearance, taste,

flavor, and convenience. However, FCFV products are very sensitive to spoilage and microbial contamination due to the processes used for its preparations (e.g. peeling, cutting, and grating). These processes caused mechanical injury to the plant tissues and promoted biochemical changes, microbial degradation, and the consequence is the loss of quality.

- ✓ Once harvested, fruits are removed from their source of water, minerals and nutrition; fruit tissues continue to respire, using available and stored sugars and organic acids and they begin to senesce rapidly.
- ✓ Postharvest quality loss is primarily a function of respiration, onset or progression of ripening (climacteric fruit), water loss (transpiration), and enzymatic discoloration of cut surfaces, decay (microbial), senescence and mechanical damage suffered during preparation, shipping, handling and processing.

Fresh-cut Fruit Quality:

Firmness and Texture: Tissue softening is a very serious problem with fresh-cut fruit products that can limit shelf life. Fresh-cut fruit firmness is an important quality attribute that can be affected by cell softening enzymes present in the fruit tissue and by decreased turgor due to water loss.

Color at the Cut Surface: An important issue in fresh-cut fruit processing is the control of discoloration (pinking, reddening or blackening) or browning at cut surfaces.

Oxidative browning is usually caused by the enzyme polyphenol oxidase (PPO) which, in the presence of O^2, converts phenolic compounds in fruits and vegetables into dark colored pigments.

Number of strategies that may be used to reduce PPO-mediated cut surface discoloration.

- ✓ Reduced O^2:
- ✓ Acidification (by dipping products in mildly acidic food grade solutions of acetic, ascorbic, citric, tartaric, fumaric or phosphoric acid)
- ✓ Reducing Agents (Ascorbic acid and erythorbate reduce PPO-induced discoloration at the cut surface by converting quinones (formed by PPO from phenolics) back to phenolic compounds.)

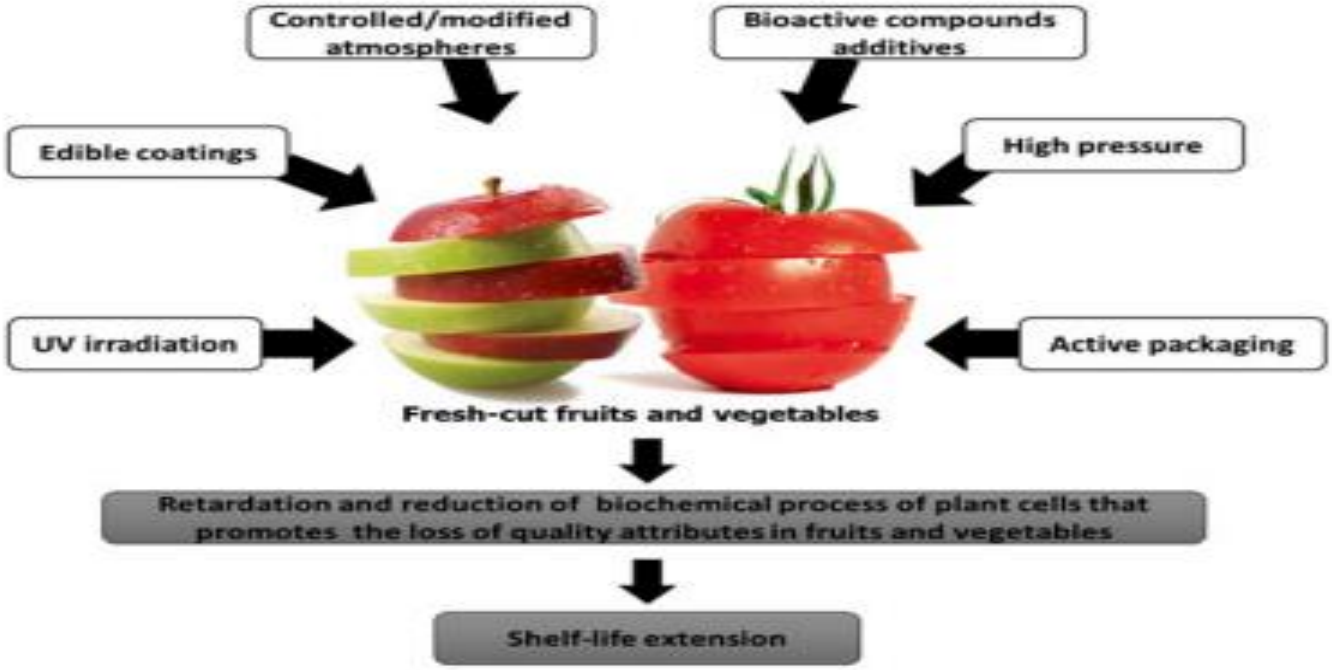

Fig. 8.1 emerging and safe technologies to preserve quality of fresh-cut fruits and vegetables

Cooling:

After processing, the cans are cooled rapidly to about **39^0C** to stop the cooking process and to prevent stack burning.

Cooling is done by the following methods:

- ✓ Dipping or immersing the hot cans in tanks containing cold water
- ✓ Letting cold water into the pressure cooker specially in case of vegetables
- ✓ Spraying cans with jets of cold water
- ✓ Exposing the cans to air

Key factors for maintaining quality and shelf life of fresh-cut vegetable products include:

- ✓ Using high quality raw product
- ✓ Using strict sanitation procedures
- ✓ Minimizing mechanical damage by using sharp knives
- ✓ Rinsing and sanitizing cut surfaces
- ✓ Drying to remove excess water
- ✓ Packaging with an appropriate atmosphere
- ✓ Scrupulous control of product temperature at 0 to 5°c (32 to 41°f) during storage, transportation and handling.

Carrots

Washing
Peeling
Cutting

Baby Carrots

Lettuce

Washing

Bagged Salad

Strawberries

Freezing

Frozen Strawberries

Fig 8.2. Cooled and wrapped fruit and vegetable

Self-check 8	**Written test**

Name…… ID…… Date…

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

Test I: Choose the best answer (6 point)

1. List the key factors for maintaining quality and shelf life of fresh-cut vegetable products:----------
   ---

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

Answer Sheet

Score = _____

Rating: _____

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

Information Sheet 9- Maintaining workplace records

9.1 Maintain workplace records

Records are observations, measurements, and other data recorded manually or by means of monitoring equipment, to document the devotion to critical limits or other processes requires. Records are the collected information produced by the industry in the process of performing and reporting industry operation**.** Maintenance is work that is carried out in order to enable its continued use and function, above a minimum acceptable level of performance, over its design service life, without unforeseen renewal or major repair activities. The maintenance concept is a brief description of the maintenance considerations, constraints and plans for operational support of the system/equipment under development.

- Information is recorded in a manner that represents an accurate history of the product or process.

- ✓ The records are legible, permanent and accurately reflect the actual events, conditions or activities.
- ✓ Errors or changes are identified so that the original record remains clear (e.g., strike out with a single stroke and initial the correction/change).
- ✓ The person in the position of responsibility at the time that the specific event occurred makes each entry on a record.
- ✓ The completed records are signed and dated by the person in the position of responsibility.
- ✓ The records are retained for at least one year after the best before date on the label or container.
- ✓ The records are maintained and are available upon request

Self-check 9	**Written test**

Name…… ID…… Date…

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

Test I: Choose the best answer (8 pts)

1. Explain the condition of recording work place information?

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

Answer Sheet

Score = _____

Rating: _____

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 4 points**

LG #39	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 closing stage
- Inspecting seams
- Identifying 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 closing stage
- Inspect seams

- Identify and 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”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.

4. Accomplish the “Self-checks” which are placed following all information sheets.

5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information Sheet 1- Monitoring closing stage

1.1. Monitoring closing stage and seams

Regular observations shall be maintained during production runs for gross closure defects. Any 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. Additional visual closure inspections shall be made immediately for observing the following:

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

Teardown examinations for double-seam cans shall be performed and the results shall be recorded at intervals of sufficient frequency on enough containers from each seaming station to ensure maintenance of seam integrity. The results of the teardown examinations shall be recorded and the corrective action taken, if any, shall be noted. Required can seam measurements:

- ✓ Micrometre measurements are required for covered hook, body hook, width, tightness for wrinkle and thickness.
- ✓ Seam scope or projector measurements are required for body hook, overlap tightness for wrinkles, and thickness by micrometre.

Double seam can terminology:

- ✓ Crossover means the portion of a double seam at the lap.
- ✓ Cutover means a fracture, sharp bend, or break in the metal at the top of the inside portion of the double seam.
- ✓ Droop means smooth projection of double seam below bottom of normal seam.
- ✓ False seam means a small seam breakdown where the cover hook and the body hook are not overlapped.

- ✓ Lap means two thicknesses of material bonded together.
- ✓ Two measurements at different locations, excluding the side seam, shall be made for each double seam characteristic if a seam scope or seam projector is used. When a micrometre is used, three measurements shall be made at points approximately one hundred twenty degrees apart, excluding the side seam.

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. For closures other than double seams and glass containers, appropriate detailed inspections and tests shall be conducted at intervals of sufficient frequency to ensure proper closing machine performance and consistently reliable hermetic seal production.Deadhead means a seam, which is incomplete due to chuck spinning in the countersink.

Self-Check – 1	Written test

Name…… ID…… Date…

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

Test I: say true or false (5 pts)

1. Regular observations shall be maintained during production runs for gross closure defects.

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

Note: **Satisfactory rating – 2.5 points** **Unsatisfactory - below 2.5 points**

Information Sheet 2- Inspecting seams

2.1. 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.

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.

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.

Seam height

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

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.

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.

The cover hook must be removed in order to inspect for wrinkling. Removal can be accomplished through manual removal with a pair of nippers or through utilization of a Seam Stripper.

1.1.1. Reverse wrinkle

A Reverse Wrinkle is a non-tightness type of wrinkle that projects towards the can body wall or the center of the can. A reverse wrinkle is formed in the first operation seam and cannot be ironed out regardless of the tightness of the second operation seam. Reverse wrinkles typically appear when seaming harder alloy and/or lighter gauge end stock.

Reverse wrinkles, in themselves, are an appearance issue. They do not attribute to leaker spoilage unless the material folds over on itself (Pucker or Pleat) and/or cracks vertically. One should not try to impose a grading system for this condition. Individual situations must be assessed, and decisions made on each separate case.

Self-Check – 2	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions (5 pts each)

1. List the factors affecting the quality of seams:----------
2. Explain each of them:----------

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

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

Information sheet 3– Identifying and reporting out-of-specification process and equipment performance

3.1. Identifying and reporting out-of-specification process

The simple definition of Out Of Specification (OSS) is when a product or drug is not meeting documented standards. The item produced is outside of the specifications the manufacturer has set for the product. Additionally, the term out of specifications, are defined as those results of in process or finished product testing, which falling out of specified limits, that are mentioned in compendia, drug master file, or drug application. The OOS may arise due to deviations in product manufacturing process, errors in testing procedure, or due to malfunctioning of analytical equipment. When an OOS has arrived, a root cause analysis has to be performed to investigate the cause for OOS. The reasons for OOS can be classified as assignable and non-assignable. When the limits are not in specified limits, called out of specifications. When OOS has occurred, the analyst should inform to QC manager. Then the senior manager will ask QA for issuing OOS form to analyst. The designated personnel will classify the OOS as either assignable cause or non-assignable cause.

A **can seamer** is a machine used to seal the lid to the can body. All cooled and wrapped product production and control records, including those for packaging and labeling, shall be reviewed and approved by the quality control unit to determine compliance with all established, approved written procedures before a batch is released or distributed. 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 vees and droops. **During the can seaming** process, the seamer chuck holds the can while the rolls rotate around it. Initially, the first operation roll folds the lid (end) and then the second operation rolls tightens the resulting seam. The first operation seam is critical to avoid problems like wrinkles (tightness issues) and leaks.

Seamer setup is usually done by an experienced individual, typically using a lifter height gauge, lifter height pressure gauge, and feeler gauges (small pieces of metal for go/no go testing of the distances between the roll and chuck toolings). New products like the clearance gauge are able to let even novice users adjust seamers and optimize them, as well as locate problems with broken/damaged tooling, shank/bushing issues, seamer adjustment issues, or broken bearings.

Some common can seamer applications include, but are not limited to:

- ✓ Cans
- ✓ Automotive filters (oil and fuel)
- ✓ Capacitors
- ✓ Certain automotive mufflers (silencers)
- ✓ Drums

Self-check 3	Written test

Name…… ID…… Date…

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

Test I: Choose the best answer (5 point)

1. Write down the importance of identifying out of specification:----------
   ----

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

Answer Sheet

Score = _____

Rating: _____

Note: **Satisfactory rating -2. 5 points** **Unsatisfactory - below 2. 5points**

LG #40	LO #4- Shut down 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 appropriate shutdown procedure • Shutting down process and cleaning • 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 appropriate shutdown procedure • Shut down process and cleaning • Identify and report maintenance requirements
Learning Instructions:
1. Read the specific objectives of this Learning Guide. 2. Follow the instructions described below. 3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them. 4. Accomplish the “Self-checks” which are placed following all information sheets. 5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information Sheet 1- Identifying appropriate shutdown procedure

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

Self-check 1	Written test

Name…… ID…… Date…

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

Test I: Choose the best answer (5 point)

1. List the Relevant regulations of shut down:----------

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

Answer Sheet

Score = _____

Rating: _____

Note: **Satisfactory rating 2. 5 points** **Unsatisfactory – below 2.5points**

Information Sheet 2- Shutting down process and cleaning

2.1. Shut 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 **m**ay include:

✓ Cleaning and sanitation procedures

✓ Equipment and facility inspection and related processes

Fig 2.1 Cleaning Equipments

✓

Fig 2.2. Cleaning Workplace first

Self-check 2	Written test

Name…… ID…… Date…

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

Test I: Choose the best answer (5 point)

1. List the steps of shut down process:----------

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

Answer Sheet

Score = _____

Rating: _____

Note: **Satisfactory rating – 2. 5 points** **Unsatisfactory - below 2.5points**

Information Sheet 3- Identifying and reporting maintenance requirements

3.1 Identify and report maintenance requirements

Major maintenance shutdowns can be stressful for both maintenance and operations personnel, but with careful planning and attention to details, they can also be very rewarding. As with non-shutdown maintenance, the single biggest factor that affects shutdown management is the operating schedule. In a plant that operates from 8 a.m. to 5 p.m. five days a week or in a power-generating station that has seasons where individual units can be shut down for extended periods, shutdown scheduling is relatively easy.

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. This will also help to prevent:

- ✓ Inaccurate test results due to equipment failure
- ✓ Delays in reporting results
- ✓ Low productivity
- ✓ Large repair costs.

Shutdown Maintenance is maintenance that can only be performed while equipment is not in use. Shutting down machinery can be costly, but sometimes due to the nature of the defective part/machine, shutdown maintenance is the only viable maintenance procedure. Four general types of maintenance philosophies are:

- ✓ Corrective,
- ✓ Preventive,
- ✓ Risk-based and
- ✓ Condition-based maintenance.

Steps to create a maintenance report in MS Word

- ✓ Create the Cover Page. Open a new document in MS Word and write the title. ...

- ✓ Cover Letter. On the next page, include the cover letter. ...
- ✓ Device Information. ...
- ✓ New Parts Cost Details. ...
- ✓ Suggestions and Signatur

Self-check 3	Written test

Name…… ID…… Date…

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

Test I: Choose the best answer (5 point)

1. Write down the types of maintenance:----------
2. List the steps of writing maintenance:----------

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

Answer Sheet

Score = _____

Rating: _____

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

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