



# Facilitator Guide



Sector  
Food Processing

Sub-Sector  
Fruits and Vegetables, Dairy Products, Meat and  
Poultry, Fish and Sea Food

Occupation  
Refrigeration

Reference ID: FIC/Q7004, Version 3.0  
NSQF level: 3

## Cold Storage Technician

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**Shri Narendra Modi**  
Prime Minister of India

“ Skilling is building a better India.  
If we have to move India towards  
development then Skill Development  
should be our mission. ”





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The preparation of this participant Handbook would not have been possible without the support of the Food Processing Industries. The Industry feedback has been extremely encouraging from inception to conclusion & it is with their inputs that we have tried to bridge the skill gaps existing today in the Industry.

This participant handbook is dedicated to all the aspiring youth who desire to achieve special skills which would be a lifelong asset for their future endeavors and help them make a bright career in the Food Processing Sector.

## About this Guide

The Facilitator Guide for Cold Storage Technician has been developed to guide the trainees on how to impart training on industry-related skills. The Facilitator Guide is aligned to the Qualification Pack (QP) and the National Occupational Standards (NOS) drafted by the 'Food Processing' sector and ratified by National Skill Development Corporation.

It includes the following National Occupational Standards (NOS):

- FIC/N7010: Prepare and maintain work area and refrigeration equipments
- FIC/N7011: Handle cold storage facility for storing food
- FIC/N7012: Complete documentation and record keeping related to the cold storage facility
- FIC/N9003: Food safety, hygiene and sanitation for storage
- DGT/VSQ/N0101: Employability Skills (30 Hours)

Post this training, the participant will be able to perform tasks as an Grain Mill Operator. We hope that this Facilitator guide provides sound learning support to the aspiring trainers and the trainees.

## Symbols Used



Ask



Explain



Elaborate



Notes



Objectives



Do



Demonstrate



Activity



Team Activity



Facilitation Notes



Practical



Say



Resources



Example



Summary



Role Play




Learning Outcomes

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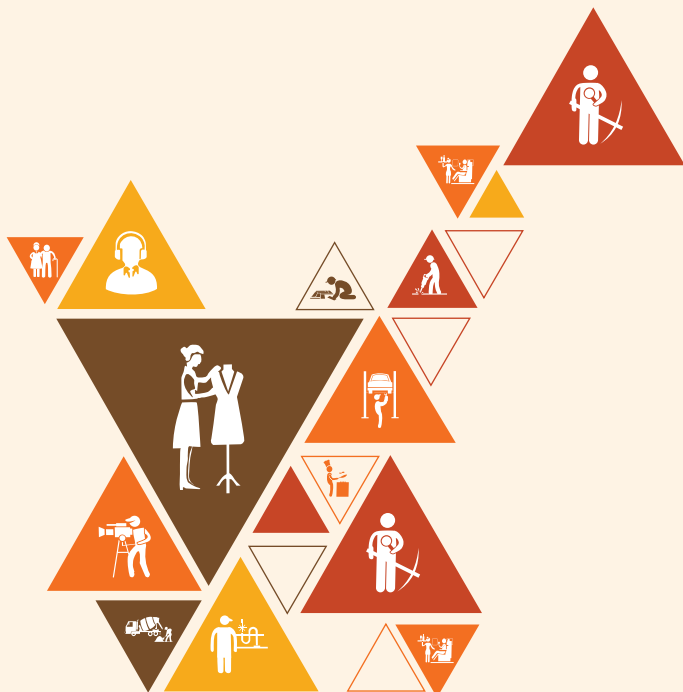
# 1. Introduction

## Unit 1.1 - Introduction to the Training Programme

## Unit 1.2 - Introduction to the Food Processing Industry

## Unit 1.3 - Packaging of Food Products and Cold Storage

## Unit 1.4 - Attributes of a Cold Storage Technician



FIC/N7010

## Key Learning Outcomes



At the end of this module, the students will be able to:

1. Explain the purpose of training
2. Discuss the National Occupational Standards and Qualification Pack
3. Define food processing
4. List the various sectors of the food processing industry
5. Describe the various stages of food processing for converting raw materials to food products
6. State the types and categories of packaging of food products
7. List the different products preserved in modified temperature
8. State the use of cold storage for food products
9. State the roles and responsibilities of a Cold Storage Technician

## Unit 1.1: Introduction to the Training Programme

### Unit Objectives

At the end of this unit, students will be able to:

1. Explain the purpose of training
2. Discuss the National Occupational Standards and Qualification Pack.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on QP and NOS, Images and Videos of QP and NOS.

### Say

Good morning, participants and a very warm welcome to this training program on “Cold Storage Technician”.

### Do

- Thank all the participants for joining and being a part of this training program
- Introduce yourself briefly to the participants, your name and background, and your role in the training program
- Tell them that you will put them at ease by playing a game. This game is meant to break the ice between everyone and get the trainees interested in the class.
- Explain the game rules you will play as an “Ice Breaker.”

### Activity

1. **Activity Name:** Name Game (Ice Breaker)
2. **Objective:** This activity is focused on breaking the ice between the participants so that they can come up confidently in putting forward their opinion
3. **Type of activity:** Group activity
4. **Resources:** Participant Handbook, Pen, Notebook, Writing Pad, etc.
5. **Duration of the activity:** 60 minutes
6. **Steps involved:**
  - Arrange the class in a semi-circle/circle
  - Say your name aloud and start playing the game with your name.
  - Say, “Now, each of you shall continue with the game with your names till the last person in the circle/ semi-circle participates”.
  - Listen to and watch the trainees while they play the game.



- Ask questions and clarify if you cannot understand or hear a trainee.
- Discourage any queries related to one's financial status, gender orientation or religious bias during the game
- Try recognising each trainee by their name because it is not recommended for a trainer to ask the name of a trainee during every interaction

**7. Outcome:** This activity has focused on breaking the ice between the participants so that they can come up confidently, putting forward their opinion.

## Ask



- What is QP and NOS?
- What is the importance of QP and NOS?

## Elaborate



- Purpose and Benefits of the Training Programme:

The training programme is based upon the National Occupational Standards for the food processing sector. The National Occupational Standards have been described in the following subsection of this chapter.

- Introduction to QP and NOS:

A QP consists of a set of National Occupational Standards (NOS). NOS specify the standard competency a worker must achieve when carrying out a function at the workplace.

## Activity



- 1. Activity Name:** Group Discussion
- 2. Objective:** This activity is focused on encouraging trainees to share their views and experiences related to the topics covered in the session.
- 3. Resources:** paper and markers.
- 4. Duration of the activity:** 20 minutes
- 5. Steps involved:**
  - Divide the trainees into groups of 4.
  - Provide each group with a flipchart paper and markers.
  - Ask each group to discuss the either one of the following questions:
    - How do you think the topics covered are relevant to your job roles?
    - How can you apply the knowledge gained from this session in your work?
  - Ask each group to write down their answers on the flipchart paper.
  - After 10 minutes, ask each group to present their answers to the rest of the class.
- 6. Outcome:** Trainees will be able to share their views and experiences related to the topics covered in the session, and will gain a better understanding of how the topics are relevant to their job roles.

## Notes for Facilitation

- Create a positive learning environment by encouraging trainees to participate and express their views.
- Ensure that the session is interactive and engaging by using a variety of teaching methods such as presentations, discussions and activities.
- Encourage trainees to ask questions and clarify their doubts about training program, QP, NOS and others.
- Provide feedback and positive reinforcement to trainees to encourage their learning and development.

## Unit 1.2: Introduction to the Food Processing Industry

### Unit Objectives

At the end of this unit, students will be able to:

1. Define food processing
2. List the various sectors of the food processing industry
3. Describe the various stages of food processing for converting raw materials to food products.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Food Processing Industry, Images and Videos of Food Processing Industry.

### Say

- Welcome everyone to this session on Introduction to the Food Processing Industry.
- Today, we will explore the importance of the food processing industry and understand the journey of food from harvest to consumer.
- By the end of this session, you will have a better understanding of the role of food processing in ensuring food safety and quality.

### Do

- Begin the session by asking the trainees about their understanding of food processing and its importance.
- Introduce the topic of food processing, its definition, and its significance in ensuring food safety and quality.
- Discuss the journey of food from harvest to consumer and the various stages involved in food processing.
- Elaborate on the different types of food processing techniques used in the industry and their benefits.

### Ask

- What comes to your mind when you think of food processing?
- How important do you think food processing is in ensuring food safety and quality?
- Can you name some food processing techniques that you are aware of?

## Elaborate

- **Food Processing:** Define food processing and explain why it is necessary. Discuss the various types of food processing, including preservation, packaging, and transportation. Emphasize the importance of food safety, quality, and sustainability in the food processing industry.
- **Journey of Food from Harvest to Consumer:** Explain the stages involved in food processing, including sorting, cleaning, packaging, and distribution. Discuss the various technologies and techniques used in each stage, including refrigeration, freezing, canning, and dehydration. Provide examples of different types of food processing, such as meat processing, dairy processing, and bakery processing.

## Activity

1. **Activity Name:** Food Processing Techniques
2. **Objective:** To identify different food processing techniques and their benefits
3. **Resources:** Images and descriptions of food processing techniques, paper, and pens
4. **Duration of the activity:** 20-30 minutes
5. **Steps involved:**
  - Divide the trainees into small groups of 4.
  - Provide each group with images and descriptions of different food processing techniques.
  - Ask each group to identify the technique, its benefits, and its application in the food industry.
  - Ask each group to present their findings to the rest of the class.
  - Discuss the different techniques and their benefits as a class.
6. **Outcome:** The trainees will have a better understanding of different food processing techniques and their applications in the industry.

## Notes for Facilitation

- Ensure that the trainees understand the importance of food safety and quality in the food processing industry.
- Encourage active participation and discussion during the session.
- Use real-life examples to illustrate the different food processing techniques and their benefits.
- Provide the trainees with handouts containing information on the topics covered in the session.
- Monitor the progress of the activity and provide support and guidance as needed.

## Unit 1.3: Packaging of Food Products and Cold Storage

### Unit Objectives

At the end of this unit, students will be able to:

1. State the types and categories of packaging of food products
2. List the different products preserved in modified temperature
3. State the use of cold storage for food products.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Food Products and Cold Storage, Images and Videos of Food Products and Cold Storage.

### Say

- Welcome to this session on packaging of food products and cold storage. In this session, we will cover different types of packaging materials and methods used for various food products and their importance in food safety and quality.
- We will also discuss the role of cold storage in preserving food products and maintaining their freshness and nutritional value.

### Do

- Start with a PowerPoint presentation on packaging of food products, covering the different types of primary, secondary, and tertiary packaging materials used for various food products.
- Demonstrate the samples of packaging materials and examples of packaging for milk, fruit, vegetables, meat, fish, poultry, bakery, and confectionery products to explain the practical application of packaging materials.
- Explain the importance of packaging in food safety and quality, including protection from contamination, preservation of freshness, and shelf-life extension.
- Move on to discuss the role of cold storage in preserving food products and maintaining their freshness and nutritional value. Use the handout on food products in cold storage to explain the concept of cold storage and its benefits.

### Ask

- What are some examples of food products that require different types of packaging?
- Why is packaging important in food safety and quality?
- How does cold storage help in preserving food products and maintaining their freshness?

## Elaborate

- **Primary packaging:** It is the first layer of packaging that comes in direct contact with the food product. It protects the food from physical, chemical, and biological damage. Examples include glass bottles, aseptic cartons, and hermetically sealed tinplate containers. It also provides important information about the product's origin, ingredients, and nutritional value.
- **Secondary packaging:** It is the layer of packaging that surrounds the primary packaging and provides additional protection and support during storage and transportation. It can be made from materials such as wood, plastic, or fiberboard. Its primary function is to protect the primary packaging from damage and contamination during handling and transportation.
- **Tertiary packaging:** It is the outermost layer of packaging that provides protection during long-distance transportation and warehousing. It is made from strong and durable materials such as pallets, stretch films, and shrink wraps. Its primary function is to protect the product from physical damage and contamination during transportation and handling.
- **Packaging of food products:** Proper packaging is critical to ensure food safety and quality. It protects the food from contamination, damage, and spoilage and extends its shelf-life. The right type of packaging material and design should be selected based on the product's characteristics and requirements.
- **Cold storage:** It is a temperature-controlled environment used to preserve food products and maintain their freshness and nutritional value. It slows down the growth of bacteria and other microorganisms that cause food spoilage and extends the shelf-life of food products. Temperature and humidity levels in the cold storage facility should be carefully monitored and controlled to ensure that the products are stored under optimal conditions.

## Activity

1. **Activity Name:** Packaging Challenge
2. **Objective:** To familiarize the trainees with different types of packaging materials and their applications in the food industry.
3. **Resources:** Samples of different packaging materials, whiteboard, and markers.
4. **Duration of the activity:** 30 minutes
5. **Steps involved:**
  - Divide the trainees into groups of 4.
  - Provide each group with a sample of different packaging materials used in the food industry.
  - Ask each group to come up with a list of food products that can be packed in the given packaging material.
  - Each group will present their list on the whiteboard.
  - The facilitator will explain the advantages and disadvantages of each packaging material and its applications in the food industry.
6. **Outcome:** The trainees will have a better understanding of different types of packaging materials and their applications in the food industry.

## Notes for Facilitation

- Encourage active participation and engagement from the trainees.
- Use real-life examples to make the session more relatable.

- Explain the advantages and disadvantages of each packaging material to provide a holistic understanding.
- Ensure that the session covers the basics of packaging and cold storage before moving on to specific food products.



## Unit 1.4: Attributes of a Cold Storage Technician

### Unit Objectives

At the end of this unit, students will be able to:

1. State the roles and responsibilities of a Cold Storage Technician

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Cold Storage Technician, Images and Videos of Cold Storage Technician.

### Say

- Good morning everyone, today we are going to discuss the attributes of a cold storage technician. As we all know, a cold storage technician plays a crucial role in maintaining the quality and quantity of produce.
- Through this session, we will learn about the responsibilities and skills required for a cold storage technician.

### Do

- Begin the session by asking the participants about their understanding of a cold storage technician's role and responsibilities.
- Explain the various responsibilities that a cold storage technician has, including receiving and assessing produce, pre-cooling, creating the right temperature, pressure, and humidity in the storage unit, loading and unloading produce, and maintaining cleanliness and hygiene of the unit.
- Discuss the skills required for a cold storage technician, such as planning, organizing, prioritizing, calculating, and handling pressure.
- Use case studies to demonstrate how these skills are essential for a cold storage technician.

### Ask

- What is your understanding of a cold storage technician's role and responsibilities?
- What are some of the essential skills that a cold storage technician should possess?

## Elaborate

- **Role and Responsibilities of a Cold Storage technician:**

A cold storage technician is responsible for maintaining and repairing refrigeration and cooling equipment used in cold storage facilities. They monitor temperature and humidity levels, perform regular maintenance and inspections, troubleshoot and diagnose equipment issues, and ensure that the facility meets safety and regulatory standards.

- **Skills Set of a Cold Storage technician:**

A cold storage technician should have a strong understanding of refrigeration and cooling systems, electrical and mechanical systems, and be skilled in troubleshooting and repairing equipment. They should also have knowledge of safety and regulatory standards, be able to work in a fast-paced environment, and have good communication and problem-solving skills.

## Demonstrate

One way to demonstrate the attributes of a cold storage technician is to use a case study. For example, you could present a scenario where a cold storage technician has to deal with unexpected produce delivery. Participants can discuss how the technician would assess the quality of the produce, decide where to store it, and calculate the right temperature and humidity levels for it. This exercise will help participants understand the skills required to be a successful cold storage technician.

## Activity

1. **Activity Name:** Prioritize Produce
2. **Objective:** To demonstrate the skill of prioritization required for a cold storage technician.
3. **Resources:** List of produce, whiteboard and markers
4. **Duration of the activity:** 20 minutes
5. **Steps involved:**
  - Divide the participants into groups.
  - Provide each group with a list of produce to be stored in a cold storage unit.
  - Ask the groups to prioritize the produce based on its quality and expiry dates.
  - Each group should present its prioritization to the class.
  - The class can discuss and compare the different prioritizations.
6. **Outcome:** This activity will help participants understand the importance of prioritizing produce in a cold storage unit and develop their prioritization skills.

## Notes for Facilitation

- Encourage participants to share their experiences and knowledge related to cold storage techniques.
- Use real-life examples and case studies to make the session more engaging.
- Emphasize the importance of maintaining hygiene and safety in a cold storage unit.

## Answers to Exercises for PHB

**Fill in the blanks with the correct option.**

- a. i. Consumers
- b. ii. Packaging
- c. ii. Tertiary
- d. i. temperature
- e. i. process flow
- f. iii. fruits and vegetables
- g. ii. -100C
- h. iii. art and science





## 2. Food Safety, Hygiene and Sanitation

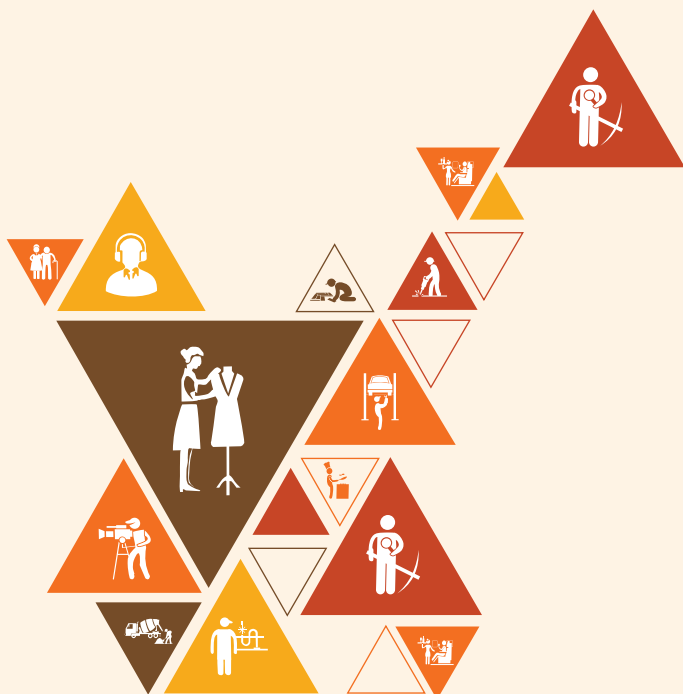
Unit 2.1 - Sanitation and Hygiene

Unit 2.2 - Safety Practices

Unit 2.3 - Good Manufacturing Practices (GMP)

Unit 2.4 - Hazard Analysis and Critical Control Point (HACCP)

Unit 2.5 - Storage Norms and Stock Rotation



FIC/N9003

## Key Learning Outcomes



At the end of this module, the students will be able to:

1. State the personal hygiene and sanitation guidelines
2. List the different sanitisers used in the process area and equipment
3. Follow health and safety practices in the work area
4. State the importance of safety, hygiene, and sanitation in the food processing industry
5. Follow the industry standards to maintain a safe and hygienic workplace
6. State the storage and stock rotation norms
7. Follow HACCP principles to eliminate food safety hazards in the process and products

## Unit 2.1: Sanitation and Hygiene

### Unit Objectives

At the end of this unit, students will be able to:

1. State the personal hygiene and sanitation guidelines
2. State the food safety hygiene standards to follow in a work environment
3. List the different sanitisers used in the process area and equipment.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Sanitation and Hygiene, Images and Videos related to Sanitation and Hygiene, Soap, Water, Hand Sanitizer and Clean Towels.

### Say

- Welcome to our session on Sanitation and Hygiene.
- Today, we will learn about personal sanitation, personal hygiene, hand washing, and how good personal hygiene can prevent food poisoning.
- This session is important for everyone to understand and practice, especially those who handle food in their work environment.

### Do

- Introduce the topic of personal sanitation and cover topics such as washing hands with soap and water, avoiding smoking, spitting, and coughing, and seeking timely medical treatment.
- Cover personal hygiene and the importance of showering and bathing regularly, keeping hair clean and covered or tied back, keeping clean clothing and footwear that is used only at work, and hand washing regularly.
- Discuss hand washing, including methods of washing hands, usage of sanitizer, and the times to wash and sanitize hands.
- Emphasize how good personal hygiene can prevent food poisoning.

### Ask

- What do you know about personal hygiene and sanitation?
- Why is personal hygiene important in the food industry?
- How can good personal hygiene practices prevent food poisoning?



## Elaborate

- **Personal Sanitation:** Personal sanitation refers to the practices of keeping oneself and one's surroundings clean and free from germs and bacteria. It includes activities such as bathing regularly, washing clothes, and keeping the living and working areas clean.
- **Personal Hygiene:** Personal hygiene refers to the practices of maintaining cleanliness and grooming oneself properly to prevent the spread of germs and disease. It includes activities such as brushing teeth, washing hands, and maintaining good oral and body hygiene.
- **Hand Washing:** Hand washing is the act of cleaning one's hands with soap and water or hand sanitizer to remove dirt, germs, and bacteria. It is an essential practice in preventing the spread of diseases and should be done before and after handling food, using the restroom, or being in contact with sick individuals.
- **Good Personal Hygiene to Prevent Food Poisoning:** Maintaining good personal hygiene is crucial in preventing food poisoning. It includes washing hands before handling food, covering one's mouth while coughing or sneezing, avoiding touching one's face or hair, and wearing clean clothes while preparing food.

## Demonstrate

- Demonstrate how to wash hands effectively using soap and water, focusing on areas around nails and wrists.
- Demonstrate the usage of hand sanitizer when soap and water are not available.

## Activity

1. **Activity Name:** Hand Washing Relay Race
2. **Objective:** To reinforce the importance of hand washing and proper techniques.
3. **Resources:** Hand washing station with soap and water, clean towels
4. **Duration of the activity:** 15-20 minutes
5. **Steps involved:**
  - Divide the participants into 4 teams.
  - Mark a starting and finishing line.
  - Place the handwashing station and clean towels at the finishing line.
  - Ask the first player of each team to run to the starting line, wash their hands with soap and water, and dry them with a clean towel.
  - Once they have completed washing their hands, they should run back to their team and tag the next player.
  - The game continues until all players have washed their hands.
  - The team that completes the relay race first wins.
6. **Outcome:** This activity helps reinforce the importance of hand washing and proper techniques in a fun and engaging way.

## Notes for Facilitation

- Encourage active participation and engagement throughout the session.
- Use examples and scenarios relevant to the participants' work environment to make the session more relatable.
- Emphasize the importance of practicing good personal hygiene practices.

## Unit 2.2: Safety Practices

### Unit Objectives

At the end of this unit, students will be able to:

1. Follow health and safety practices in the work area.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Safety Practices, Images and Videos of Safety Practices, Fire extinguisher and Fire Bucket.

### Say

- Good morning trainees and welcome to our session on Safety Practices.
- Today, we will learn about Safety symbols, Emergency Measures and Fire Safety Measures.

### Do

- Introduce the topic of safety symbols and emergency measures by presenting a PowerPoint on safety symbols commonly used in workplaces and explaining their meanings.
- Discuss the emergency evacuation plan and the trainees' roles and responsibilities during emergency situations.
- Discuss fire safety measures, including how to prevent fires, types of fires, and how to use fire extinguishers and fire buckets.
- Distribute handouts on emergency evacuation plans and fire safety measures, and encourage trainees to review them and ask any questions they may have.
- Demonstrate the use of a fire extinguisher and fire bucket.

### Elaborate

- Safety Symbols:

Safety symbols are used to convey important information related to hazards, precautions, and actions to take to avoid danger. Some common safety symbols include the "Biohazard" symbol, which indicates the presence of a biological hazard that can cause harm to human health; the "High Voltage" symbol, which warns of the presence of high voltage electrical equipment or lines; and the "Flammable" symbol, which warns of flammable materials that can ignite and cause fire. It is important to understand and recognize these symbols to ensure safety in the workplace and in daily life. (Refer to fig 2.2.1. Safety symbols in PH)

- **Emergency Measures:**

During emergency situations, it is important to have a well-defined evacuation plan and know what to do. The emergency evacuation plan should be reviewed regularly and all employees should be familiar with it. The plan should include exit routes, designated meeting points, and emergency contact information. It is also important to know how to respond to different emergency situations, such as fire, earthquake, or severe weather, and to know the appropriate actions to take. (Refer to fig 2.2.2, 2.2.3, 2.2.4 Safety symbols in PH)

- **Fire Safety Measures:**

Fires can be caused by various factors, including electrical faults, smoking, cooking, and heating appliances. To prevent fires, it's crucial to follow proper safety measures, such as keeping flammable materials away from heat sources, turning off appliances when not in use, and avoiding smoking near combustible materials. Knowing the different types of fires and the appropriate type of fire extinguisher for each is also crucial. There are four types of fires: A, B, C, and D, each requiring a specific type of extinguisher. It's important to learn how to use a fire extinguisher and fire bucket, and to practice using them in simulated emergency situations.

## Demonstrate

Demonstrate the use of a fire extinguisher and fire bucket, showing how to hold and aim the extinguisher and how to use a fire bucket to put out a fire.

## Activity

1. **Activity Name:** Fire Extinguisher Training
2. **Objective:** Train trainees on how to use a fire extinguisher safely and effectively.
3. **Resources:** Fire extinguisher, fire bucket, training fire simulator
4. **Duration of the activity:** 30 minutes
5. **Steps involved:**
  - Divide the trainees into groups of 3.
  - Provide each group with a fire extinguisher and a fire bucket.
  - Have them practice using the fire extinguisher to put out a fire on the training fire simulator.
  - Monitor each group and provide feedback on their technique.
  - After each group has practiced, conduct a debriefing session, discussing the strengths and areas for improvement.
6. **Outcome:** Trainees will have gained practical experience in using a fire extinguisher and feel more confident in their ability to use one in an emergency situation.

## Notes for Facilitation

- Emphasize the importance of safety in the workplace and encourage trainees to take safety seriously.
- Use examples and anecdotes to illustrate the importance of safety practices.
- Be clear and concise in your instructions, and use visual aids to help trainees understand the concepts.

- During the fire extinguisher demonstration, ensure that the area is safe and free of any potential hazards.
- Encourage trainees to ask questions and participate actively in the training session.

## Unit 2.3: Good Manufacturing Practices (GMP)

### Unit Objectives

At the end of this unit, students will be able to:

1. State the importance of safety, hygiene, and sanitation in the food processing industry
2. Follow the industry standards to maintain a safe and hygienic workplace
3. State the storage and stock rotation norms.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Good Manufacturing Practices (GMP), Images and Videos of Good Manufacturing Practices (GMP), Handouts on Personnel Hygiene, Pen and Paper For Note-Taking.

### Say

- Good morning trainees and welcome to our session on Good Manufacturing Practices (GMP).
- Today, we will learn about Good Manufacturing Practices, Personnel hygiene, Sanitation of the work area.
- We will also discuss the importance of GMP, the regulatory requirements, and how to implement GMP in your workplace.

### Do

- Start the session by discussing the basics of GMP, followed by personnel hygiene, sanitation of work area, equipment maintenance, and process validation.
- Use PowerPoint presentations and handouts to explain the topics and engage the participants in discussions.
- Provide relevant case studies to help participants understand the practical implementation of GMP.

### Ask

- What is your understanding of GMP?
- What are the regulatory requirements for GMP?
- How can you implement GMP in your workplace?

## Elaborate

- **Good Manufacturing Practices (GMP):** GMP refers to the procedures and practices that ensure that food products are safe, of high quality, and meet the regulatory standards. It includes personnel hygiene, sanitation of work area, equipment maintenance, and process validation.
- **Personnel hygiene:** Personnel hygiene is an essential component of GMP. It includes maintaining personal hygiene, following strict hygiene and sanitation guidelines, being in good health during working hours, following high standards of cleanliness, and having adequate facilities for toilets and wash stations.
- **Sanitation of the work area:** The work area should be located in a clean, pollution-free area, well ventilated with adequate lighting, follow high standards of cleaning and sanitisation, and have a designated area for keeping utensils and equipment, which should be kept clean and pest-free at all times.
- **Equipment maintenance:** The equipment used for processing foods should be protected against contamination from lubricants, metal fragments, fuel, and contaminated water. Cleaning and maintenance of tools, materials, and equipment should be an easy process, and organisations should follow a cleaning and sanitising drill as per daily, weekly, and monthly schedules.
- **Process validation:** All processes of production, such as raw material procurement, execution, storage, packaging, and logistics, should follow strict organisational parameters. Quality checks should be conducted at each step of production to ensure that food quality is maintained as per prescribed norms and standards. The stock rotation of finished products should follow the FEFO and FIFO methods to ensure minimum chances of food spoilage and retain the taste of processed foods.

## Activity

1. **Activity Name:** Equipment Inspection and Maintenance
2. **Objective:** To reinforce the importance of equipment maintenance
3. **Resources:** Sample equipment, cleaning and sanitizing agents, inspection checklist
4. **Duration of the activity:** 30 minutes
5. **Steps involved:**
  - Divide the trainees into groups of four.
  - Provide each group with a sample equipment and inspection checklist.
  - Instruct the groups to inspect the equipment, identify any defects or issues, and discuss the maintenance procedures required to address them.
  - Instruct the groups to clean and sanitize the equipment using the cleaning and sanitizing agents provided.
  - Instruct the groups to complete the inspection checklist and discuss their findings and recommendations with the entire group.
6. **Outcome:** The trainees will learn the importance of equipment inspection and maintenance to prevent contamination and ensure safe production.

## Notes for Facilitation

- Provide a safe and comfortable learning environment.
- Encourage participation and engagement from all trainees.



- Ensure that the trainees understand the importance of equipment inspection and maintenance in the manufacturing process.
- Emphasize the need for regular equipment inspection and maintenance to ensure that the equipment is functioning optimally and to prevent contamination.
- Address any questions or concerns that the trainees may have during the session and provide additional information as needed.

## Unit 2.4: Hazard Analysis and Critical Control Point (HACCP)

### Unit Objectives

At the end of this unit, students will be able to:

1. Follow HACCP principles to eliminate food safety hazards in the process and products.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Hazard Analysis and Critical Control Point (HACCP), Images and Videos of Hazard Analysis and Critical Control Point (HACCP), Case Study Handout, Pen and Paper.

### Say

- Welcome to this session on Hazard Analysis and Critical Control Point or HACCP.
- Today, we will be learning about the principles and guidelines of HACCP, and how it is used to ensure food safety.
- Emphasize that this session will cover the basics of HACCP and provide examples of how it is applied in real life.

### Do

- Use the PowerPoint presentation to explain the principles of HACCP.
- Discuss the case studies to demonstrate how HACCP is applied in different industries.
- Provide an example HACCP plan and explain how it is developed.

### Ask

- Have you heard of HACCP before? What do you know about it?
- Why do you think HACCP is important?
- Can you think of any industries where HACCP might be used?

### Elaborate

- What is HACCP?

HACCP stands for Hazard Analysis and Critical Control Points, which is a systematic approach to food safety that aims to prevent hazards or risks that may occur during food production processes. The HACCP system involves identifying potential hazards, establishing critical control points, monitoring, and controlling them throughout the food production process.

- **Example of HACCP Plan**

An example of a HACCP plan for a food processing plant may include identifying potential hazards, such as biological, chemical, or physical hazards, at each stage of the production process. Critical control points may include temperature control, cleaning and sanitation procedures, and testing and sampling of raw materials and finished products. Monitoring and control measures may include routine checks and tests, regular equipment maintenance, and employee training on proper food handling procedures..

## Activity

1. **Activity Name:** HACCP Plan Development
2. **Objective:** To apply the principles of HACCP to develop a plan
3. **Resources:** Case study materials, flipchart and markers, handouts
4. **Duration of the activity:** 45 minutes
5. **Steps involved:**
  - Divide the trainees into 4 groups.
  - Provide each group with a case study.
  - Instruct the groups to develop an HACCP plan for the case study.
  - Provide guidance and answer questions as needed.
  - Have each group present their plan to the class.
6. **Outcome:** Trainees will have a better understanding of how to develop an HACCP plan.

## Notes for Facilitation

- Encourage participation and discussion from all trainees.
- Ensure that everyone has an opportunity to ask questions and provide input.
- Emphasize the importance of HACCP and the potential consequences of not using it.
- Stress the need for a systematic approach to hazard identification and control.
- Provide real-life examples to illustrate the principles of HACCP.

## Unit 2.5: Storage Norms and Stock Rotation

### Unit Objectives

At the end of this unit, students will be able to:

1. State the storage norms for safe storage of food in a MA storage
2. State the different stock rotation methods used in food processing industry.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Storage Norms and Stock Rotation, Images and Videos of Storage Norms and Stock Rotation.

### Say

- Welcome, everyone. Today we are going to talk about food storage and stock rotation, which are essential for maintaining the quality and safety of our food products.
- We will cover the best practices for storing food, the meaning of stock rotation, and two common methods of stock rotation - FIFO and FEFO.
- By the end of this session, you will be able to understand how to store food properly, how to rotate stock efficiently, and how to ensure that the oldest products are used first.

### Do

- Start the session by asking the three questions in the Ask section.
- Introduce the topics covered in the session.
- Present the handouts on food storage and stock rotation, and explain the key points using examples of different food products.
- Demonstrate how to apply FIFO and FEFO methods of stock rotation with sample food products.

### Ask

- What are some common food safety hazards that can occur during storage?
- Why is it important to rotate stock?
- What are the advantages of using FIFO and FEFO methods of stock rotation?

## Elaborate

- **Food Storage:** Food storage refers to the process of storing food products in a safe and hygienic manner to prevent contamination, spoilage, and wastage. It involves selecting the appropriate storage conditions, such as temperature and humidity levels, and using proper packaging and labeling methods to ensure the quality and safety of the food.
- **Meaning of Stock Rotation:** Stock rotation is the process of arranging and using products in a specific order to prevent spoilage, expiration, and waste. It involves arranging the products according to their expiry dates or production dates and using the oldest products first while keeping the newer products at the back. This ensures that the products are used before their expiry date, and the risk of spoilage and wastage is minimized.
- **FIFO:** FIFO stands for “First In, First Out” and is a stock rotation method used to manage inventory. It involves using the oldest products first and ensuring that the newer products are stored at the back. This method ensures that the products are used before their expiry date, reduces the risk of spoilage, and prevents overstocking of products.
- **FEFO:** FEFO stands for “First Expiry, First Out” and is a stock rotation method that prioritizes using the products that are closest to their expiry date. It involves checking the expiry dates of the products and using the ones that are closest to expiration first. This method reduces the risk of spoilage and ensures that the products are used before they expire.

## Demonstrate

Show how to check the product code date, move older products to the front or top, and place new products at the back or bottom.

## Activity

1. **Activity Name:** Stock Rotation Game
2. **Objective:** To reinforce the learning objectives and improve understanding of the FIFO and FEFO methods of stock rotation.
3. **Resources:** Sample food products, shelves, trays, timers.
4. **Duration of the activity:** 20 minutes
5. **Steps involved:**
  - Divide the trainees into teams of 2-3 members.
  - Provide each team with a shelf or tray and a set of sample food products with different expiry dates.
  - Set a timer for 10 minutes and ask the teams to apply the FIFO method to organize the products on the shelf/tray.
  - After 10 minutes, stop the timer and ask each team to explain how they organized the products.
  - Reset the timer for another 10 minutes and ask the teams to apply the FEFO method to organize the products.
  - After 10 minutes, stop the timer and ask each team to explain how they organized the products using the FEFO method.
  - Ask the teams to switch shelves/trays with another team and repeat the exercise, this time with a different set of products.

- After the activity, gather the teams and ask them to share their experiences and observations regarding the application of the FIFO and FEFO methods.
  - Highlight the importance of stock rotation and emphasize the need to ensure the safety and suitability of food products.
  - Encourage the teams to ask questions and clarify any doubts they may have regarding the topic.
6. **Outcome:** This activity will help the trainees to reinforce their understanding of the FIFO and FEFO methods of stock rotation. It will also provide them with hands-on experience in applying these methods to organize food products. Through the sharing of experiences and observations, the trainees will also gain insights into the best practices and challenges associated with stock rotation.

## Notes for Facilitation

- Encourage participation and interaction among trainees to keep the session engaging and informative.
- Use real-life examples to explain the importance of proper storage and stock rotation in the food industry.
- Throughout the session, reinforce the learning objectives covered and emphasize the importance of following proper storage and stock rotation practices.
- Emphasize the importance of following safety guidelines while handling food products, including the use of gloves and washing hands before and after handling food.
- Follow up with trainees after the session to ensure they understand the importance of proper storage and stock rotation practices and how to apply them in their workplace.

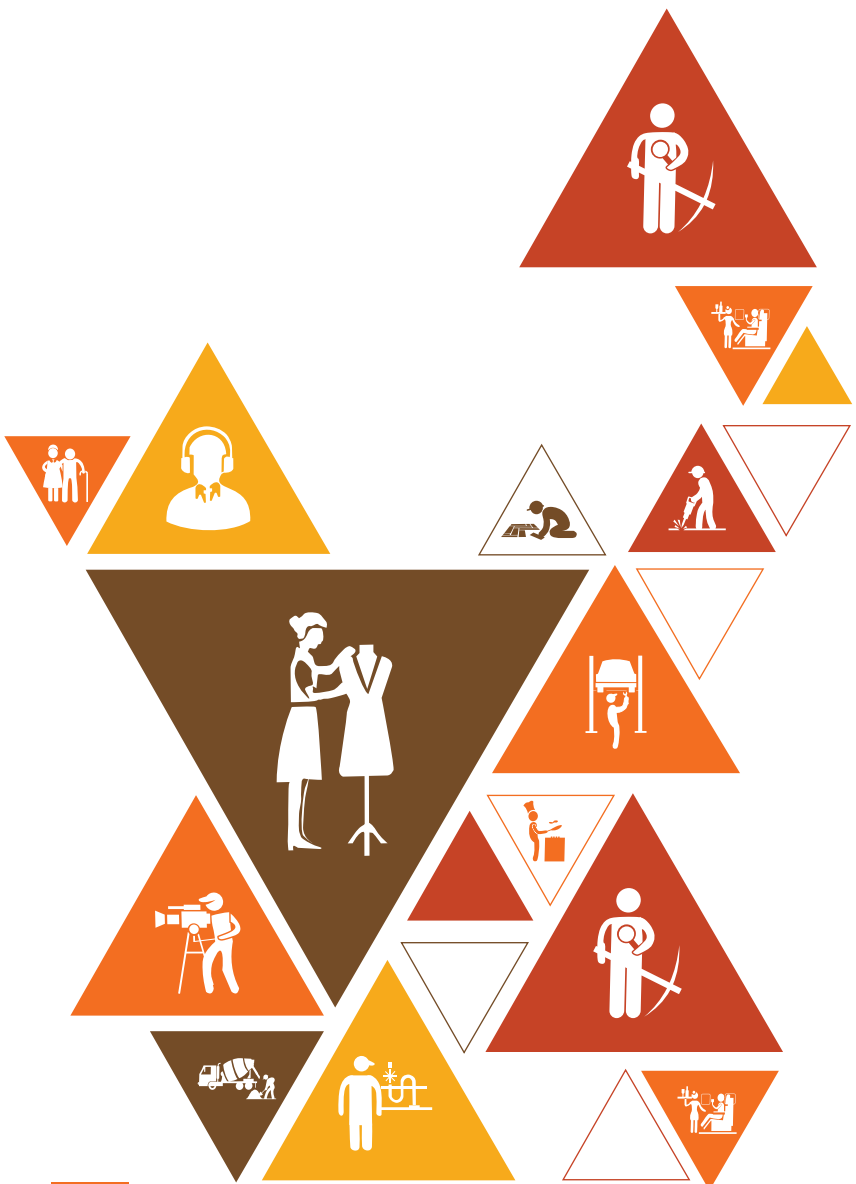
## Answers to Exercises for PHB

### 1. Tick with the correct option.

- a. iv. All of the above
- b. i. Coldest part of the basement
- c. ii. Process Validation
- d. i. Perishable
- e. iv. Spoilage

### 2. Match the columns

- a. vi. Identify critical control points
- b. iii. Establish critical limits
- c. vii. Establish corrective measures
- d. ii. State verification procedures
- e. i. Follow record-keeping procedures
- f. v. Conduct a hazard analysis
- g. iv. Establish a monitoring system







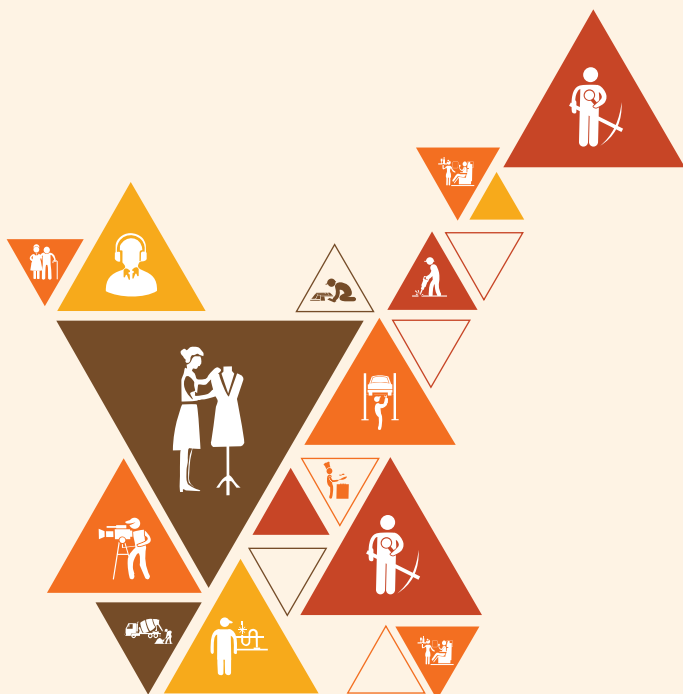
## 3. Prepare and Maintain Work Area and Refrigeration Equipment

Unit 3.1 - Equipment used in Refrigeration Process

Unit 3.2 - Sanitisation of the Work Area

Unit 3.3 - Cleaning Processes

Unit 3.4 - Usage and Maintenance of Equipment and Machineries



FIC/N7010

## Key Learning Outcomes



At the end of this module, the students will be able to:

1. Identify the different equipment used in the refrigeration process
2. State the materials and equipment used in cleaning and maintenance of the work area and machineries
3. List the various cleaning chemicals required
4. State the cleaning processes used to clean the work area and process machineries
5. Dispose waste as per organisation standards and industry requirements.

## Unit 3.1: Equipment used in Refrigeration Process

### Unit Objectives

At the end of this unit, students will be able to:

1. Identify the different equipment used in the refrigeration process.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Equipment used in Refrigeration Process, Images and Videos of Equipment used in Refrigeration Process.

### Say

- Good morning everyone to the class on equipment used in the refrigeration process. Today, we will be discussing the different types of equipment used to cool and store products in refrigeration units.
- Throughout the session, feel free to ask questions and share your thoughts. I encourage active participation and discussion.

### Do

- Begin the session with an icebreaker activity to encourage interaction and set a positive tone for the class.
- Use the PowerPoint presentation to guide the discussion and highlight the key points of each type of equipment.
- Encourage group discussion and reflection on the material covered, and use the whiteboard to illustrate key concepts.
- Allow time for questions and clarification throughout the session.

### Ask

- What is your experience with refrigeration equipment?
- Can you name some refrigeration equipment you have worked on?
- What are the benefits of using high-quality refrigeration equipment in food storage?

## Elaborate

- **Compressors:** Compressors are the heart of the refrigeration system, responsible for compressing the refrigerant gas and raising its temperature before it flows through the condenser. This process is essential to remove the heat absorbed by the evaporator and expel it outside the system. There are two main types of compressors: reciprocating and rotary. Reciprocating compressors use a piston to compress the refrigerant, while rotary compressors use a rotating screw or blade.
- **Condensers:** Condensers are designed to transfer heat from the refrigerant to the surrounding environment, causing it to condense into a liquid form. This is achieved by circulating air or water over a series of tubes containing the hot refrigerant gas, allowing the heat to be transferred to the surrounding environment. There are two types of condensers: air-cooled and water-cooled. Air-cooled condensers use fans to circulate air over the tubes, while water-cooled condensers use water to absorb the heat.
- **Evaporators:** Evaporators are responsible for absorbing heat from the surrounding environment, causing the refrigerant to evaporate and cool the storage space. The evaporator consists of a series of tubes that allow the refrigerant to expand and evaporate, drawing heat from the surrounding environment. This cold refrigerant is then circulated back to the compressor, where the process starts over again. There are two types of evaporators: air-cooled and water-cooled. Air-cooled evaporators use fans to circulate air over the tubes, while water-cooled evaporators use water to absorb the heat.
- **Expansion devices:** Expansion devices regulate the flow of refrigerant through the system to ensure that it is properly balanced and cooling is effective. The expansion device controls the pressure and temperature of the refrigerant as it passes from the high-pressure side of the system (the condenser) to the low-pressure side (the evaporator). There are several types of expansion devices, including thermostatic expansion valves, capillary tubes, and electronic expansion valves. The type of expansion device used depends on the specific requirements of the refrigeration system.

## Demonstrate

Show videos of different types of compressors, condensers, evaporators, and expansion devices and demonstrate how they work.

## Activity

1. **Activity Name:** Equipment Identification
2. **Objective:** To identify different types of refrigeration equipment
3. **Resources:** Images and diagrams of refrigeration equipment
4. **Duration of the activity:** 20 minutes
5. **Steps involved:**
  - Divide the class into small groups.
  - Provide each group with images and diagrams of different refrigeration equipment.
  - Ask each group to identify and label each type of equipment.
  - Have each group share their findings with the rest of the class.
6. **Outcome:** Increased knowledge and understanding of different types of refrigeration equipment.

## Notes for Facilitation

- Encourage participation and discussion throughout the session.
- Use real-life examples and case studies to illustrate key points.
- Emphasize the importance of proper maintenance and upkeep of refrigeration equipment.
- Be prepared to answer technical questions about the equipment.
- Use visual aids and hands-on activities to engage learners and reinforce key concepts.

## Unit 3.2: Sanitisation of the Work Area

### Unit Objectives

At the end of this unit, students will be able to:

1. State the materials and equipment used in cleaning and maintenance of the work area and machineries
2. List the various cleaning chemicals required.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Sanitisation of the Work Area, Images and Videos related to Sanitisation of the Work Area, Cleaning Equipment such as Mops, Buckets, Scrubbers, Brushes, High Spray Nozzle Jets and Sanitisers.

### Say

- Welcome everyone to the session on sanitisation of the work area.
- Today, we will learn about the importance of cleaning and sanitising the work area, the types of materials and equipment used for cleaning, the method of cleaning, and the frequency of cleaning process machineries.

### Do

- Begin the session with a PowerPoint presentation on cleaning and sanitisation.
- Demonstrate the use of different cleaning equipment such as mops, buckets, scrubbers, brushes, and high spray nozzle jets.
- Explain the importance of using the correct cleaning and sanitising agents and chemicals for different surfaces and equipment.
- Discuss the proper method of cleaning the work area and the frequency of cleaning process machineries.

### Ask

- What are the consequences of not properly sanitising the work area?
- How often do you think process machineries should be cleaned?
- What are some of the materials and equipment that can be used for cleaning?

## Elaborate

- **Cleaning and Sanitisation:** Cleaning and sanitisation are critical processes in any manufacturing or processing facility. These processes involve the removal of dirt, dust, and other contaminants from surfaces and equipment to prevent the growth and spread of bacteria, viruses, and other harmful microorganisms. Cleaning involves physically removing dirt and debris from surfaces, while sanitisation involves using disinfectants or sanitisers to kill germs and bacteria.
- **Types of materials and equipment used for cleaning:** There are several types of materials and equipment used for cleaning and sanitisation in a manufacturing or processing facility. These include mops, buckets, scrubbers, brushes, high spray nozzle jets, cleaning chemicals and sanitisers, a cleaning or washing tank, and knives and spoons. It is important to use the right equipment for each task to ensure that surfaces and equipment are properly cleaned and sanitised.
- **How to use these materials and equipment:** It is important to train employees on the proper use of cleaning materials and equipment to ensure that they are used safely and effectively. Employees should be taught the correct way to mix cleaning chemicals and sanitisers and the proper use of equipment such as high spray nozzle jets, brushes, and scrubbers. Using the wrong equipment or chemicals can lead to ineffective cleaning or even damage to equipment and surfaces.
- **The method of cleaning the work area:** There is a proper method of cleaning the work area that should be followed to ensure that surfaces and equipment are properly cleaned and sanitised. This includes starting from the top and working down to prevent the spread of dirt and debris, using the right equipment for each task, and properly disposing of waste materials.
- **The frequency of cleaning process machineries:** The frequency of cleaning process machineries should be based on the type of machinery and the type of product being processed. Some machinery may need to be cleaned after every use, while others may only need to be cleaned on a weekly or monthly basis. It is important to follow the recommended cleaning frequency to ensure that the machinery is properly cleaned and sanitised and to prevent contamination of the product being processed.

## Demonstrate

Demonstrate the proper use of cleaning equipment such as mops, buckets, scrubbers, brushes, and high spray nozzle jets, as well as the proper way to mix cleaning chemicals and sanitisers.

## Activity

1. **Activity Name:** Cleaning Equipment Relay Race
2. **Objective:** To reinforce the importance of using the correct cleaning equipment and the proper cleaning method.
3. **Resources:** Mops, buckets, scrubbers, brushes, high spray nozzle jets, and cleaning chemicals and sanitisers.
4. **Duration of the activity:** 15-20 minutes
5. **Steps involved:**
  - Divide the trainees into two teams.
  - Place a set of cleaning equipment at one end of the room and an empty bucket at the other end for each team.
  - The first person on each team must run to the cleaning equipment, grab one piece of equipment, and run back to the empty bucket to deposit it.

- The next person on the team must run to the cleaning equipment, grab a different piece of equipment, and run back to the bucket to deposit it.
  - Continue until all the equipment has been deposited in the bucket.
  - The team with all the equipment properly deposited in the bucket wins.
6. **Outcome:** This activity reinforces the importance of using the correct cleaning equipment

## Activity

1. **Activity Name:** Cleaning and Sanitizing
2. **Objective:** To reinforce the learnings of the session and help trainees apply the knowledge in a practical way
3. **Resources:** Cleaning equipment and materials, demonstration work area, activity sheets
4. **Duration of the activity:** 30 minutes
5. **Steps involved:**
  - Divide the trainees into 2 groups.
  - Provide them with a demonstration work area and cleaning equipment and materials.
  - Ask them to clean and sanitize the work area using the methods and equipment discussed in the session.
  - After completion, ask them to fill out an activity sheet, evaluating their performance and providing feedback.
6. **Outcome:** The trainees will be able to apply the knowledge learned in the session and reinforce their understanding of cleaning and sanitizing the work area.

## Notes for Facilitation

- Encourage trainees to ask questions and participate in discussions.
- Use real-life examples to help them relate to the importance of maintaining a clean work area and proper sanitization.
- Provide clear and concise instructions on the correct use of cleaning materials and equipment.
- Emphasize the importance of following proper cleaning and sanitization procedures to prevent contamination and ensure product safety.
- Demonstrate the correct technique for cleaning and sanitizing different types of equipment and surfaces.
- Ensure that trainees understand the differences between cleaning, sanitizing, and disinfecting, and when each process is necessary.
- Encourage trainees to take responsibility for maintaining a clean and sanitized work area and to report any issues or concerns to the appropriate person.
- Provide feedback and support throughout the session to reinforce learning and encourage participation.



## Unit 3.3: Cleaning Processes

### Unit Objectives

At the end of this unit, students will be able to:

1. State the cleaning processes used to clean the work area and process machineries.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Cleaning Processes, Images and Videos of Sanitisation of the Work Area.

### Say

- Welcome to the class on Cleaning Processes. In this session, we will cover Clean-In-Place, Clean-Out-Of-Place, and Sterilising-In-Place processes.
- The objective of this class is to help you understand the importance of proper cleaning processes and how to effectively clean equipment and work areas to ensure food safety.

### Do

- Start the session with an icebreaker activity to create a comfortable and engaging learning environment.
- Introduce the topics of Clean-In-Place, Clean-Out-Of-Place, and Sterilising-In-Place processes, and provide an overview of each topic using the PowerPoint presentation.
- Use the flipchart to explain the tips for conducting an effective COP process, and the food processing equipment and units that undergo the COP process.
- Demonstrate how to clean different types of equipment and surfaces using the cleaning equipment and materials, and encourage trainees to participate in the demonstration.
- Provide handouts on cleaning and sanitising solutions, flow rate, and COP process order of tasks, and go through each handout with the trainees.

### Ask

- What cleaning processes are you familiar with?
- Why is it important to use the right cleaning and sanitising solutions?

## Elaborate

- **Clean-In-Place (CIP):** CIP is a method used to clean the interior surfaces of equipment and pipelines without disassembling them. It involves circulating cleaning solutions through the system to remove residue and contaminants, followed by rinsing with water to ensure the removal of all cleaning agents.
- **Clean-Out-Of-Place (COP):** COP is a cleaning method that involves removing parts of equipment or tools and cleaning them separately in a designated cleaning area. It is used for parts that cannot be cleaned using the CIP method. The parts are disassembled, cleaned, and then reassembled back into the equipment or tool.
- **Sterilising-In-Place (SIP):** SIP is a method used to sterilize equipment and pipelines using high-temperature steam or chemicals. It is usually done after CIP to ensure that all microorganisms have been eliminated from the equipment.
- **Air-Pressure Cleaning:** Air-pressure cleaning is a method used to clean surfaces or equipment by blowing high-pressure air onto the surface. It is typically used to remove dry or loose contaminants, such as dust, dirt, and debris.
- **Process of Cleaning the Work Area:** The process of cleaning the work area involves removing all unnecessary items, wiping down surfaces, and disposing of waste in designated containers. This ensures that the work area is free of contaminants and ready for the next task.
- **Process of Cleaning Machineries, Tools, and Equipment:** The process of cleaning machineries, tools, and equipment involves dismantling, washing, sanitizing, and drying the items using appropriate cleaning agents and methods. It ensures that the equipment is free of contaminants and ready for use.

## Demonstrate

Demonstrate the COP process using the samples of food processing equipment and units. Show the trainees how to disassemble the equipment, clean it in tanks, and reassemble it.

## Activity

1. **Activity Name:** COP Simulation
2. **Objective:** To practice the COP process and understand the importance of following the correct order of tasks and using the right cleaning tanks and tools.
3. **Resources:** Samples of equipment used in the COP process, cleaning and sanitising solutions, cleaning tanks, and tools.
4. **Duration of the activity:** 30 minutes
5. **Steps involved:**
  - Divide the trainees into small groups.
  - Provide each group with samples of equipment used in the COP process, cleaning and sanitising solutions, cleaning tanks, and tools.
  - Instruct each group to follow the correct order of tasks for the COP process, use the right cleaning tanks, using the right tools, and make sure that the tools used do not lead to contamination.
  - Ask the groups to designate a leader who will oversee the entire process and ensure that everyone is following the correct procedures.
  - Give the groups 20 minutes to complete the simulation.

- After the simulation is complete, reconvene the groups and ask each leader to share their experience and the challenges they faced during the simulation.
6. **Outcome:** By participating in the COP simulation activity, trainees will understand the importance of following the correct order of tasks and using the right cleaning tanks and tools in the COP process. They will also learn how the use of the right tools and cleaning tanks can prevent contamination and ensure that the equipment is thoroughly cleaned.

## Notes for Facilitation

- Be enthusiastic and energetic throughout the session to keep the trainees engaged.
- Ensure that the learning objectives are clear and communicated to the trainees at the beginning of the session.
- Emphasize the importance of following the correct cleaning process and using the right solutions, tools, and equipment.
- Encourage trainees to ask questions and clarify any doubts they may have during the session.
- Highlight the significance of monitoring and verifying the cleaning process to ensure that it is effective and meets the required standards.

## Unit 3.4: Usage and Maintenance of Equipment and Machineries

### Unit Objectives

At the end of this unit, students will be able to:

1. Explain the maintenance procedure to be followed for dairy processing machineries to be followed in Cold storages before starting production
2. State the different types of maintenance procedures

### Resources to be Used

Handbook, Projector, Laptop/Computer, Internet, White Board, Flip Chart, Markers, PowerPoint presentation on Usage and Maintenance of Equipment and Machineries, Pictures and Videos of Usage and Maintenance of Equipment and Machineries.

### Say

- Welcome everyone to the session on Usage and Maintenance of Equipment and Machineries.
- Today we will discuss various methods of maintenance and cleaning processes used in the food industry.
- We will also go through a checklist for planning maintenance and understand the importance of proactive and preventive maintenance.

### Do

- Introduce the topic of maintenance and cleaning processes in the food industry.
- Ask trainees about their experiences with maintenance and cleaning processes in their workplaces.
- Explain the different types of maintenance and cleaning processes in detail.
- Conduct an activity related to the learning objectives.
- Summarize the key takeaways and provide handouts/checklists for future reference.

### Ask

- Have you ever experienced machine breakdowns at your workplace? How were they resolved?
- What do you think is the importance of proactive and preventive maintenance in the food industry?

## Elaborate

- **Types of Maintenance:** There are three types of maintenance - corrective maintenance, preventive maintenance, and predictive maintenance. Corrective maintenance is performed after a failure occurs, preventive maintenance is performed at regular intervals, and predictive maintenance is performed based on data analysis to predict when maintenance is needed.
- **Maintenance and Check:** Maintenance and check refer to the regular inspection, cleaning, and repair of equipment to ensure that it is functioning properly and efficiently. This helps to prevent equipment failures and ensure that the equipment is safe to use.
- **Checklist for Planning Maintenance:** A checklist for planning maintenance is a tool used to plan and schedule maintenance tasks. It includes a list of tasks to be performed, the frequency of the tasks, the tools and equipment needed, and the personnel responsible for the tasks. The checklist helps to ensure that all necessary tasks are completed on time and that the equipment is properly maintained.

## Demonstrate

- Demonstrate the cleaning process for a piece of equipment using appropriate cleaning and sanitizing solutions.
- Demonstrate the oiling process for a machine using the appropriate oiling equipment.

## Activity

1. **Activity Name:** Maintenance Planning
2. **Objective:** To create a maintenance plan for critical equipment in the facility.
3. **Resources:** Whiteboard, markers, maintenance schedule template
4. **Duration of the activity:** 30-45 minutes
5. **Steps involved:**
  - Divide participants into groups of 4.
  - Provide each group with a maintenance schedule template.
  - Ask each group to identify critical equipment and their maintenance needs.
  - Have each group create a maintenance plan for the identified equipment.
  - After 20-30 minutes, have each group present their maintenance plan to the larger group.
  - Facilitate a discussion on the common themes and differences between the plans.
6. **Outcome:** Participants will have a better understanding of the importance of maintenance planning and will have created a maintenance plan for critical equipment in the facility.

## Notes for Facilitation

- Encourage participation and discussion among participants.
- Emphasize the importance of creating a maintenance plan for critical equipment.
- Provide examples of successful maintenance programs in the food industry.
- Ensure participants understand the difference between the various types of maintenance.
- Address any questions or concerns participants may have about implementing a maintenance program.

## Answers to Exercises for PHB

### 1. Tick with the correct option

- a. ii. COP
- b. i. CIP
- c. ii. COP
- d. i. Hydrogen peroxide

### 2. The correct sequence of food spoilage is:

- a. Equipment is removed and wiped
- b. High pressure air is blown towards ovens and conveyors
- c. Equipment is re-fitted
- d. Equipment is oiled and greased

### 3. Match the column

- a. Compressor - iii. Rotary compressor
- b. Condenser - ii. Water-cooled
- c. Evaporator - iv. Dry expansion evaporator
- d. Expansion Device - i. Float valves

### 4. Answers:

- a. Compressor
- b. Condenser
- c. Evaporator
- d. Expansion device
- e. Refrigerant

### 6. Identified food contact and non-food contact surfaces

- a. Work tables - Non-food contact surface
- b. Overhead structures - Non-food contact surface
- c. Utensils - Food contact surface
- d. Air conditioner - Non-food contact surface
- e. Ventilating systems - Non-food contact surface
- f. Lighting equipment - Non-food contact surface
- g. Refrigeration equipment - Non-food contact surface
- h. Walls and ceilings - Non-food contact surface
- i. Tools like knives - Food contact surface
- j. Machines that process food - Food contact surface



## Unit 4.1 - Basic Principles of Refrigeration

## Unit 4.2 - Installation of Refrigeration

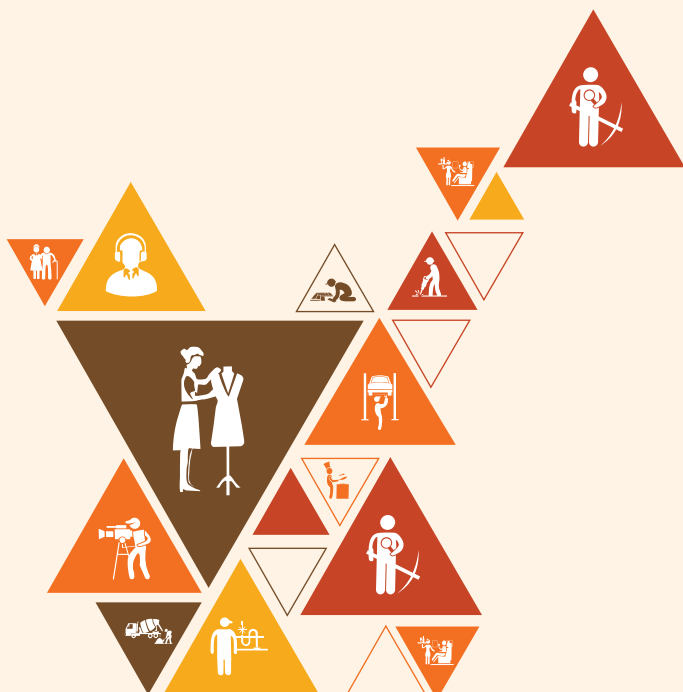
## Unit 4.3 - Basic Calculations

## Unit 4.4 - Storage of Food in Cold Storage

## Unit 4.5 - Methods to Monitor Food in Cold Storage

## Unit 4.6 - Quality Assessment

## Unit 4.7 - Repair and Maintenance



FIC/N7011

## Key Learning Outcomes



At the end of this module, the students will be able to:

1. State the refrigeration principles, techniques and practices
2. Interpret drawings and diagrams of a cold storage system and facility
3. List the components of refrigeration system and their installation
4. List the type of refrigerants and the procedure to handle them
5. State the methods to calibrate the testing equipment
6. Calculate the load in a cold storage refrigerant
7. Identify the types of food that can be stored in cold storage
8. State the storage parameters for various type of food
9. State the methods to monitor and control the cold storage facility
10. State the procedure for charging refrigerant in the refrigeration system
11. State the process of quality assessment
12. Identify faults in a refrigeration system
13. State the procedure for repairing and maintenance of the refrigeration system.



## Unit 4.1: Basic Principles of Refrigeration

### Unit Objectives

At the end of this unit, students will be able to:

1. State the refrigeration principles, techniques and practices
2. Interpret drawings and diagrams of a cold storage system and facility.

### Resources to be Used

Handbook, Projector, Laptop/Computer, Internet, White Board, Flip Chart, Markers, PowerPoint presentation on Principles of Refrigeration, Pictures and Videos of Principles of Refrigeration.

### Say

- Welcome to the class on Basic Principles of Refrigeration.
- In this session, we will be discussing the basic principles of refrigeration, which is an important concept in the food industry. Refrigeration is used to preserve and store food products to maintain their quality and freshness.
- By the end of this session, you will have a clear understanding of how refrigeration works and its different components.

### Do

- Start the session by asking participants to introduce themselves.
- Display the presentation slides and provide a brief overview of the topics to be covered.
- Use diagrams and visual aids to explain the refrigeration cycle and the different components such as the compressor, condenser, evaporator, and expansion valve.
- Explain the concepts of pressure, temperature, and heat transfer in the refrigeration cycle.
- Discuss the different types of refrigerants used in refrigeration systems and their properties.
- Allow time for questions and discussions.

### Ask

- What is your understanding of refrigeration?
- How does refrigeration help in preserving and storing food products?

## Elaborate

- Refrigeration is a process that involves the removal of heat from a confined space and transferring it to a different location. This process is essential for preserving perishable food products, medical supplies, and other temperature-sensitive materials.
- The refrigeration cycle comprises four main components: compressor, condenser, evaporator, and expansion valve. Each component plays a crucial role in the efficient functioning of the refrigeration system.
- The compressor is responsible for pumping the refrigerant gas to a high pressure and temperature. This process increases the energy level of the refrigerant, allowing it to absorb heat from the surrounding area.
- The hot gas then flows to the condenser, where it releases heat and condenses into a high-pressure liquid. The condenser helps to cool down the refrigerant and remove the heat energy that it has absorbed from the surrounding area.
- The high-pressure liquid then flows to the expansion valve, where it is allowed to expand and decrease in pressure. This causes the refrigerant to evaporate and absorb more heat from the surrounding area.
- The refrigerant gas then flows to the evaporator, where it absorbs more heat and evaporates into a low-pressure gas. The evaporator helps to cool down the surrounding area by absorbing the heat energy from it.
- The low-pressure gas then flows back to the compressor to start the cycle again. This continuous cycle helps to maintain the desired temperature inside the refrigeration system.
- Different types of refrigerants such as R-134a, R-22, and R-404a have different properties and are used for specific applications. For example, R-134a is commonly used in automotive air conditioning systems, while R-404a is used in commercial refrigeration systems. It is important to choose the right refrigerant based on the specific application to ensure optimum efficiency and safety.

## Demonstrate

Use a refrigeration cycle diagram to explain how the components work together to maintain a low temperature.

## Activity

1. **Activity Name:** DIY Refrigeration Experiment
2. **Objective:** To demonstrate the basic principles of refrigeration through a simple DIY experiment.
3. **Resources:** A plastic bottle, Water, Salt, Ice, small container, thermometer and towel.
4. **Duration of the activity:** 30-45 minutes
5. **Steps involved:**
  - Divide the trainees into 2 groups.
  - Ask the participants to fill the plastic bottle with water and add a pinch of salt.
  - Instruct them to insert the thermometer in the bottle and take the initial reading of the temperature.
  - Ask them to put the bottle in the small container and surround it with ice.
  - Instruct them to cover the bottle and the container with a towel.

- Ask them to wait for 10-15 minutes and take the temperature reading again.
- Discuss the changes in temperature and explain how the experiment demonstrates the basic principles of refrigeration.

**6. Outcome:** Participants will understand the basic principles of refrigeration through a simple DIY experiment.

## Notes for Facilitation

- Ensure that all participants have access to the required resources.
- Encourage the participants to ask questions and share their observations during the activity.
- Emphasize the importance of safety while handling ice and salt.
- Explain the concept of refrigeration and the role of different components like compressor, condenser, evaporator, and expansion valve.
- Relate the concept to real-life examples like air conditioning and refrigeration systems in homes and industries.

## Unit 4.2: Installation of Refrigeration

### Unit Objectives

At the end of this unit, students will be able to:

1. List the components of refrigeration system and their installation
2. List the type of refrigerants and the procedure to handle them
3. State the methods to calibrate the testing equipment.

### Resources to be Used

Handbook, Projector, Laptop/Computer, Internet, White Board, Flip Chart, Markers, PowerPoint presentation on Installation of Refrigeration, Pictures and Videos related Installation of Refrigeration.

### Say

- Welcome everyone to the session of installation of refrigeration class.
- Today, we will learn about the basic components of a refrigeration system, types of refrigerants, and start-up procedures.

### Do

- Start the presentation and go through the slides.
- Demonstrate the sample refrigeration system and the tools needed for installation and start-up.
- Take questions and encourage participation from the trainees.

### Ask

- What do you know about refrigeration systems?
- What challenges do you anticipate in installing a refrigeration system?
- How do you plan to ensure safety during the installation process?

### Elaborate

- Refrigeration is the process of removing heat from a confined space and transferring it to a different location.
- The basic components of a refrigeration system are the evaporator, compressor, condenser, expansion valve, and refrigerant.
- The evaporator is where the refrigerant absorbs heat from the surrounding area and evaporates into a low-pressure gas.

- The compressor pumps the refrigerant gas to a high pressure and temperature, which then flows to the condenser where it releases heat and condenses into a high-pressure liquid.
- The expansion valve allows the refrigerant to expand and decrease in pressure, causing it to evaporate and absorb heat from the surrounding area.
- The refrigerant then flows back to the compressor to start the cycle again.
- Different types of refrigerants have different properties and are used for specific applications.
- Proper installation and start-up of a refrigeration system is important to ensure efficient operation and prevent safety hazards.

## Demonstrate

Demonstrate the installation and start-up process using the sample refrigeration system and the necessary tools.

## Activity

1. **Activity Name:** Installation of Refrigeration System
2. **Objective:** To provide hands-on experience in installing a refrigeration system and following the proper installation steps.
3. **Resources:** Refrigeration system components, tools and equipment, installation manual.
4. **Duration of the activity:** 60 minutes
5. **Steps involved:**
  - Divide the trainees into 3 groups.
  - Provide each group with a refrigeration system components and installation manual.
  - Instruct the groups to follow the steps in the installation manual and install the refrigeration system.
  - Monitor the progress of each group and provide guidance where necessary.
  - After the installation is complete, ask each group to present their installation and discuss the key points and safety precautions.
6. **Outcome:** The trainees will have hands-on experience in installing a refrigeration system and will understand the proper installation steps and safety precautions.

## Activity

1. **Activity Name:** Field Visit
2. **Objective:** To observe a functioning refrigeration system in operation and gain practical experience in installation and start-up procedures.
3. **Resources:** Personal protective equipment (PPE)
4. **Duration of the activity:** 2 hours
5. **Steps involved:**
  - Visit a functioning refrigeration system installation with a certified technician.
  - Observe the installation and start-up procedures.

- Ask questions and take notes.

6. **Outcome:** Trainees will have practical experience in the installation and start-up procedures of a refrigeration system.

## Notes for Facilitation

- Provide clear instructions and encourage participation from the trainees.
- Emphasize the importance of safety and proper use of tools and equipment.
- Demonstrate proper installation and start-up procedures.
- Allow time for questions and feedback.
- Remind trainees of the importance of ongoing maintenance and monitoring of refrigeration systems.

## Unit 4.3: Basic Calculations

### Unit Objectives

At the end of this unit, students will be able to:

1. Calculate the load in a cold storage refrigerant.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Basic Calculations, Images and Videos of Basic Calculations and Calculator.

### Say

- Welcome to the session on Installation of Refrigeration.
- In this session, we will learn about basic calculations involved in refrigeration system installation.
- The calculation of refrigeration load is essential to ensure proper system installation and operation. We will discuss different components of load calculation and how to calculate them.

### Do

- Introduce the topic by briefly discussing the importance of proper refrigeration load calculation in ensuring the efficient operation of a refrigeration system.
- Explain the various components of load calculation, including insulation heat leak, air changes, lights, product load, fan load, and defrost heat.
- Use the printed copies of the load calculation formula to guide the trainees through each step of the calculation.
- Provide examples of different refrigeration load scenarios and ask the trainees to calculate the refrigeration load for each scenario.

### Ask

- Why is refrigeration load calculation important in the installation of a refrigeration system?
- What are the different components of refrigeration load calculation?
- Can you provide an example of a refrigeration load calculation scenario?

## Elaborate



- **Basic Calculations:** Basic calculations refer to mathematical operations such as addition, subtraction, multiplication, and division. They are used in various industries to perform simple and complex calculations related to production, inventory, and finance.
  - **Cold store refrigeration load:** Cold store refrigeration load refers to the amount of heat that needs to be removed from a cold storage facility to maintain the desired temperature. It is calculated based on factors such as the size of the facility, the insulation properties of the walls and ceiling, the outside temperature, and the type and quantity of products stored. Proper calculation of the refrigeration load is essential for the efficient operation of the cold storage facility.

## Activity



1. **Activity Name:** Load Calculation Exercise
2. **Objective:** To reinforce the learning of refrigeration load calculation
3. **Resources:** Printed copies of the load calculation formula, calculator
4. **Duration of the activity:** 30 minutes
5. **Steps involved:**
  - Divide the trainees into four groups.
  - Distribute printed copies of the load calculation formula and calculators to each group.
  - Provide a refrigeration load calculation scenario to each group.
  - Ask the groups to calculate the refrigeration load for their scenario.
  - After 15 minutes, ask each group to present their calculation to the class.
  - Discuss the different approaches used by each group to solve the problem and provide feedback.
6. **Outcome:** The activity will reinforce the learning of refrigeration load calculation and provide the trainees with an opportunity to apply their knowledge in solving real-world refrigeration load scenarios.

## Notes for Facilitation



- Keep the explanations simple and easy to understand.
- Encourage the trainees to ask questions and seek clarification if they do not understand any part of the session.
- Provide additional resources and reading materials to the trainees for further learning.
- Highlight the importance of proper refrigeration load calculation in ensuring the efficient operation of a refrigeration system.
- Provide feedback and constructive criticism to the trainees during the activity to reinforce the learning outcomes.



## Unit 4.4: Storage of Food in Cold Storage

### Unit Objectives

At the end of this unit, students will be able to:

1. Identify the types of food that can be stored in cold storage
2. State the storage parameters for various type of food.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Storage of Food in Cold Storage, Images and Videos of Storage of Food in Cold Storage.

### Say

- Welcome everyone to the session on Storage of Food in Cold Storage.
- In this session, we will learn about the best practices for handling and storing food items in cold storage.
- Our goal is to ensure that you leave this session with a better understanding of the proper storage mix, handling of food items and other important considerations when it comes to food storage in cold environments.

### Do

- Use the PowerPoint presentation and whiteboard to guide the session and present key points.
- Demonstrate proper handling and storage techniques using containers of different sizes and ice packs.
- Allow time for questions and discussion.

### Ask

- What are some challenges you've faced when storing food in cold environments?
- What are some best practices for handling food items in cold storage?
- Why is it important to maintain proper temperatures in cold storage?

## Elaborate

- Cold storage requires specific temperature requirements for different types of food items, ranging from -18°C for frozen food to 4°C for perishable items.
- Types of cold storage include walk-in coolers and freezers, reach-in refrigerators and freezers, and blast chillers.
- Maintaining a cold chain, which refers to the continuous refrigeration of food items from production to consumption, is important to ensure food safety and prevent spoilage.
- Proper handling and storage of meat, dairy, fruits and vegetables, and grains involves considerations such as packaging, storage temperature, and placement in cold storage.
- The storage mix, or the practice of storing different types of food items together in cold storage, can affect food safety by increasing the risk of cross-contamination and compromising shelf life.
- Guidelines for proper storage mix include separating different food items, storing raw meat and poultry at the bottom of the cooler, and maintaining proper temperature and humidity levels.

## Demonstrate

- Show how to properly measure and record the temperature of a cold storage unit.
- Demonstrate proper handling and storage techniques for different types of food items.

## Activity

1. **Activity Name:** Temperature Check
2. **Objective:** To demonstrate proper temperature measurement techniques and reinforce the importance of maintaining proper cold storage temperatures.
3. **Resources:** Thermometer, whiteboard and markers
4. **Duration of the activity:** 10 minutes
5. **Steps involved:**
  - Divide participants into pairs.
  - Provide each pair with a thermometer and ask them to measure the temperature of a cold storage unit.
  - Ask each pair to record their results on the whiteboard.
  - Discuss the results as a group and identify any issues or concerns.
6. **Outcome:** Participants will have a better understanding of the importance of proper temperature measurement and the impact it has on food safety.

## Notes for Facilitation

- Encourage participation and questions throughout the session.
- Ensure that participants understand the importance of maintaining proper cold storage temperatures.
- Emphasize the importance of proper handling and storage techniques for different types of food items.

- Provide examples of best practices and common mistakes when it comes to cold storage and food safety.
- Reinforce the importance of following food safety guidelines and regulations in all food storage and handling practices.

## Unit 4.5: Methods to Monitor Food in Cold Storage

### Unit Objectives

At the end of this unit, students will be able to:

1. State the methods to monitor and control the cold storage facility
2. State the procedure for charging refrigerant in the refrigeration system.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Methods to Monitor Food in Cold Storage, Images and Videos of Methods to Monitor Food in Cold Storage.

### Say

- Welcome everyone to the class on Methods to Monitor Food in Cold Storage.
- Today, we will learn about the basic methods to monitor food in cold storage.

### Do

- Start by presenting the slides on different methods to monitor food in cold storage.
- Provide examples of temperature logs and discuss best practices for keeping records of temperature readings.
- Demonstrate the proper use of temperature monitoring equipment, such as a thermometer or data logger.
- Conduct an activity where participants practice taking and recording temperature readings in a cold storage unit.

### Ask

- What are some risks associated with inadequate temperature monitoring in cold storage?
- What are some common types of temperature monitoring equipment used in cold storage?
- What are some best practices for record-keeping and documentation of temperature readings?

## Elaborate

- **Methods to Monitor Food in Cold Storage:**

There are various methods to monitor food in cold storage, such as temperature monitoring, humidity monitoring, and air circulation monitoring. These methods help to ensure that the food is stored under optimal conditions, prevent spoilage and contamination, and maintain food safety and quality. Regular monitoring is essential to identify any issues and take corrective action before it's too late.

## Demonstrate

Demonstrate the proper use of temperature monitoring equipment, including how to place the equipment in the coldest part of the storage unit and how to record temperature readings accurately.

## Activity

1. **Activity Name:** Temperature Monitoring Challenge
2. **Objective:** To practice monitoring and recording temperatures in a cold storage facility and identify potential issues and corrective actions.
3. **Resources:** Thermometers, temperature monitoring software or devices, sample temperature logs, and records.
4. **Duration of the activity:** 30-45 minutes
5. **Steps involved:**
  - Divide participants into four groups.
  - Provide each group with a thermometer, temperature monitoring software or device, and a sample temperature log.
  - Assign each group to monitor and record temperatures at different locations in a cold storage facility (e.g., refrigerator, freezer, storage room).
  - Instruct each group to identify any temperature deviations or issues and recommend corrective actions based on the sample temperature logs.
  - After 20-30 minutes, gather the groups and ask them to share their findings and recommendations.
  - Facilitate a group discussion on the challenges and best practices of temperature monitoring in cold storage.
6. **Outcome:** Participants will have a hands-on experience of temperature monitoring and recording and develop problem-solving skills to address potential issues.

## Notes for Facilitation

- Encourage active participation and engagement from all participants.
- Foster a respectful and inclusive learning environment.
- Manage time and pace to cover all topics and activities effectively.
- Emphasize the importance of accurate and timely temperature monitoring to prevent foodborne illness and quality issues.

- Provide examples and case studies of temperature monitoring practices in different types of food facilities.
- Discuss the regulatory requirements and standards for temperature monitoring in cold storage, such as the FDA Food Code or the HAC

## Unit 4.6: Quality Assessment

### Unit Objectives

At the end of this unit, students will be able to:

1. State the process of quality assessment.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Quality Assessment, Images and Videos of Quality Assessment.

### Say

- Welcome to the Quality Assessment session. In this session, we will learn about the importance of quality assessment, how to conduct quality assessment, and the benefits of conducting quality assessment.
- During the session, we will cover the topics namely what is quality assessment, why is quality assessment important, how to conduct quality assessment.

### Do

- Introduce yourself and explain the purpose and objectives of the session.
- Start with the PowerPoint presentation, covering each topic in detail.
- Use examples and ask questions to engage the trainees.
- Distribute the quality assessment checklist handout and ask trainees to use it for note-taking and as a reference during the session.
- Encourage trainees to ask questions and participate in discussions.

### Ask

- What is quality assessment?
- Why is quality assessment important?

## Elaborate

- **Quality Assessment:** Quality assessment refers to the process of evaluating the quality of a product or service based on specific criteria or standards. In the food industry, quality assessment is essential to ensure that the product meets the required quality standards and specifications.
  - **Steps for Quality Control and Assessment Measures:** The steps for quality control and assessment measures in the food industry include establishing quality standards, conducting regular inspections, implementing corrective actions, and continuously monitoring and improving the quality management system. These steps help to ensure that the food products are safe, meet regulatory requirements, and satisfy the customers' needs and expectations.

## Demonstrate

- Demonstrate how to conduct a quality assessment using a food sample.
- Show trainees how to identify the criteria or standards, collect data, and analyze data.

## Activity

1. **Activity Name:** Quality Assessment Checklist
2. **Objective:** To apply the concepts learned in the session to conduct a quality assessment.
3. **Resources:** Quality assessment checklist handout, pen/pencil and paper.
4. **Duration of the activity:** 30 minutes
5. **Steps involved:**
  - Ask trainees to form groups of two.
  - Distribute the quality assessment checklist handout to each group.
  - Ask each group to choose a product or service they want to assess.
  - Instruct each group to conduct a quality assessment using the checklist handout.
  - After 20 minutes, ask each group to share their findings with the rest of the class.
6. **Outcome:** Trainees will be able to apply the concepts learned in the session to conduct a quality assessment.

## Notes for Facilitation

- Encourage participation and ask questions to engage trainees.
- Provide feedback and positive reinforcement to trainees.
- Emphasize the importance of quality assessment in improving the quality of products or services.
- Encourage trainees to use the quality assessment checklist handout as a reference during the session.
- Provide examples of how quality assessment has helped other companies to improve their products or services.



## Unit 4.7: Repair and Maintenance

### Unit Objectives

At the end of this unit, students will be able to:

1. Identify faults in a refrigeration system
2. State the procedure for repairing and maintenance of the refrigeration system.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Repair and Maintenance, Images and Videos related to Repair and Maintenance.

### Say

- Welcome to the Repair and Maintenance session. In this class, we will cover various topics related to repairing and maintaining refrigeration systems.
- The purpose of this session is to provide you with knowledge and skills to identify and fix common faults in refrigeration systems, maintain them, and repair cooling systems.

### Do

- Start by introducing yourself and explaining the objectives of the class.
- Use a combination of lecture, discussion, and practical activities to engage the participants.
- Encourage participants to ask questions and share their experiences related to the topics covered in the class.

### Ask

- What are some common faults that you have encountered in refrigeration systems?
- What tools and equipment do you think are necessary for repairing and maintaining refrigeration systems?

### Elaborate

- Repair and Maintenance
  - Common Faults
  - Repairs to the cooling system
  - Refrigerated containers

## Demonstrate

Demonstrate how to repair a refrigeration system, such as replacing a compressor or repairing a refrigerant leak. Use diagrams and practical demonstrations to illustrate the process.

## Activity

1. **Activity Name:** Fault Finding Exercise
2. **Objective:** To identify and diagnose faults in a refrigeration system.
3. **Resources:** Refrigeration system diagram, handouts with common faults, tools and equipment
4. **Duration of the activity:** 45 minutes
5. **Steps involved:**
  - Divide participants into groups of three or four.
  - Provide each group with a refrigeration system diagram and handouts with common faults.
  - Ask each group to identify and diagnose faults in the system and recommend possible solutions.
  - Provide tools and equipment for practical activities.
  - Allow 30 minutes for the activity, followed by a 15-minute discussion of the findings and solutions.
6. **Outcome:** Participants will have a better understanding of how to identify and diagnose faults in refrigeration systems.

## Notes for Facilitation

- Ensure the safety of the participants during practical activities.
- Encourage participants to share their experiences related to repairing and maintaining refrigeration systems.
- Emphasize the importance of regular maintenance to prevent costly repairs.
- Discuss environmental and safety regulations related to refrigeration systems.
- Monitor participants' progress and provide feedback to improve their skills.

## Answers to Exercises for PHB

### 1. Sequence of the refrigeration cycle

- a. iii. Compression of the refrigerant gas.
- b. i. Cooling and condensation of the refrigerant to liquid.
- c. ii. Expansion and partial evaporation of the liquid into a lower pressure which causes cooling.
- d. v. Continued evaporation of the liquid in the 'cold box' - further heating by removal of sensible heat from the item being cooled, to provide the latent heat of vaporization of the refrigerant.
- e. iv. Re-compression of the vapor to begin the cycle again.

### 2. Answer of the following Questions

- a. Compressor
- b. Condenser
- c. Expansion valve
- d. Evaporator
- e. Refrigerant

### 3. Correct order:

- a. i. Obtain a thermometer that is certified or calibrated for the temperature ranges that will be used during standardisation procedure.
- b. ii. Place certified or calibrated thermometer in the oil or water bath and adjust the bath to the temperature range of the thermometer to be tested.
- c. iii. Record the reading from of the thermometer being tested and the temperature of bath.
- d. iv. After the temperature has stabilised, place the thermometer being tested next to the certified or calibrated thermometer.
- e. v. If needed, adjust thermometer to correct temperature and retest. A correction factor may be applied to non-adjustable thermometers up to  $\pm 5.00^{\circ}\text{F}$  or  $\pm 2.80^{\circ}\text{C}$ .

### 4. Storage parameters for some agricultural crops:

- a. Cherry      2-4 weeks
- b. Kiwi        6-8 months
- c. Peach      2-4 weeks
- d. Plum        2-3 weeks

### 5. Correct option are:

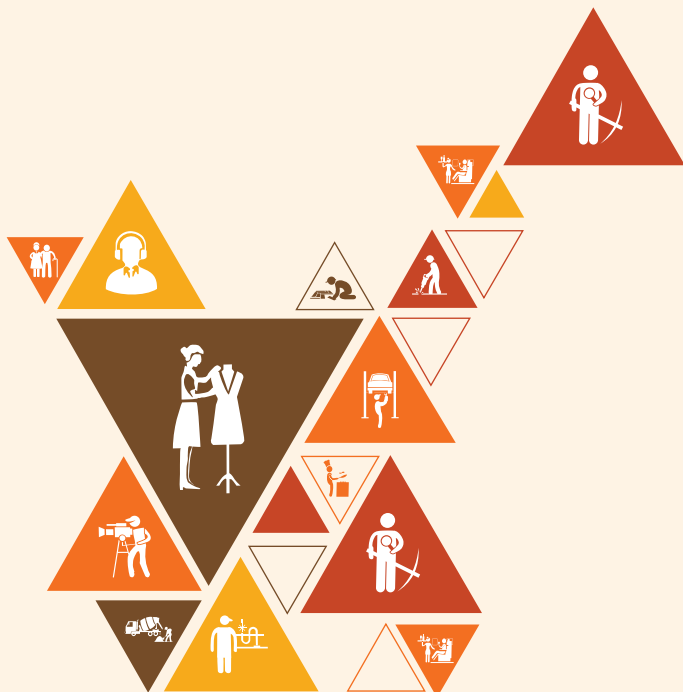
- a. ii. temperature
- b. iv. alarm
- c. iii. monthly
- d. i. gas
- e. i. charging
- f. ii. circulate
- g. iii. condenser
- h. iv. very high

- i. ii. Temperature
- j. iv. separate
- k. iv. taste, texture and nutritional value
- l. ii. law



## 5. Complete Documentation and Record Keeping Related to Cold Storage Facility

Unit 5.1 - Documentation and Record Keeping



FIC/N7012

## Key Learning Outcomes



At the end of this module, the students will be able to:

1. State the need for documenting and maintaining records of raw materials, process, and finished products
2. State the method of documenting and recording the details of raw material to final finished product
3. State the functions of ERP system
4. Observe the various facilities, machineries and cold storage process in the food processing industry.

## Unit 5.1: Documentation and Record Keeping

### Unit Objectives

At the end of this unit, students will be able to:

1. State the need for documenting and maintaining records of raw materials, process, and finished products
2. State the method of documenting and recording the details of raw material to final finished product
3. State the functions of ERP system.

### Resources to be Used

Participant handbook, Projector, Laptop/Computer with the internet, White Board, Flip Chart, Markers, PowerPoint presentation on Documentation and Record Keeping, Images and Videos of Documentation and Record Keeping.

### Say

- Welcome everyone to the session on Documentation and Record Keeping.
- Today, we will learn about the importance of documentation, how to keep records effectively, and an introduction to ERP solutions.
- By the end of the session, you will understand the benefits of good record keeping and how to use ERP software to streamline your documentation processes.

### Do

- Begin the session by introducing the topic of documentation and record keeping.
- Use visual aids and real-life examples to demonstrate the importance of accurate and detailed record keeping.
- Provide an overview of the types of documentation used in various industries and why they are important.
- Discuss the key principles of effective record keeping, such as accuracy, consistency, and completeness.
- Introduce ERP solutions and how they can be used to improve documentation and record keeping processes.

### Ask

- What are some examples of documentation that you encounter in your work?
- How do you currently keep track of important information and data?

## Elaborate

- Need for Documentation
- How to Keep Records?
  - Product quality can be maintained only when
  - Every batch of food is given a batch number. This number is recorded in
- Introduction to ERP Solutions
  - ERP System

## Demonstrate

Show examples of how ERP solutions have been used to improve documentation processes in various industries.

## Activity

1. **Activity Name:** Documenting a Business Process
2. **Objective:** To practice creating accurate and complete documentation for a business process
3. **Resources:** Handouts and worksheets
4. **Duration of the activity:** 30 minutes
5. **Steps involved:**
  - Divide participants into groups of three or four.
  - Assign each group a specific business process to document.
  - Provide handouts and worksheets for participants to use as templates for their documentation.
  - Encourage participants to work collaboratively to ensure accuracy and completeness of their documentation.
  - After 25 minutes, ask each group to present their documentation to the rest of the class.
6. **Outcome:** Participants will have practical experience in creating accurate and complete documentation for a business process.

## Notes for Facilitation

- Provide ample time for questions and discussion throughout the session.
- Use real-life examples to demonstrate the importance of accurate and detailed record keeping.
- Encourage participants to share their own experiences and insights on documentation and record keeping.
- Emphasize the importance of accuracy, completeness, and consistency in record keeping.
- Ensure that participants have a clear understanding of how to use the ERP software before the end of the session.



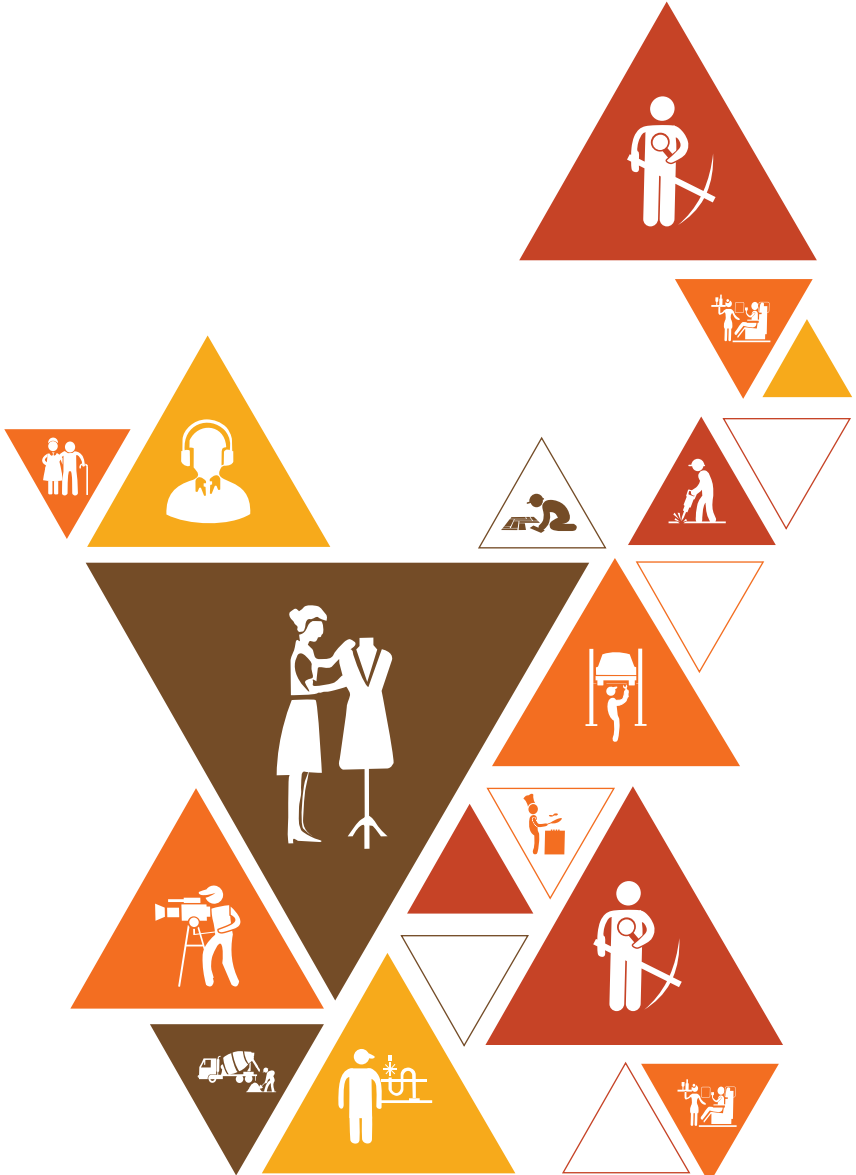
## Answers to Exercises for PHB

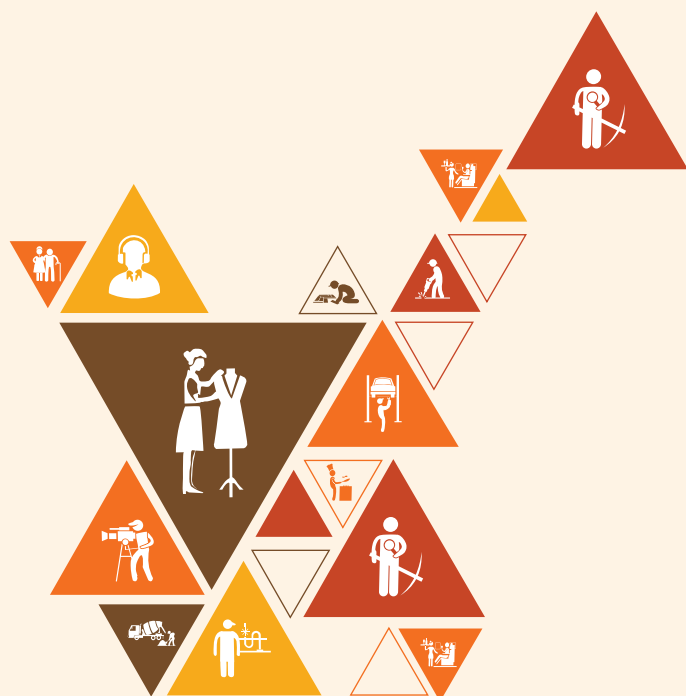
### 1. The correct options are:

- a. Options i, ii, iv, v, vii, viii, x, xii, xiii are correct.
- b. Options i, iii, iv, and v are correct.

### 2. Match the columns

- a. Every production process completed is given a number viii. Batch number
- b. The details of raw material procurement are noted i. Stock control books
- c. The details of the production process are noted v. Processing log books
- d. The details of product sales are recorded vi. Sales and distribution log
- e. Records serve as vii. Legal evidence
- f. Properly maintained records help to identify whether iii. Quality procedures are followed
- g. ERP system iv. Plex
- h. Enterprise Resource Planning ii. Facilitates flow of information





DGT/VSQ/N0101

Scan the QR codes or click on the link to watch the related videos

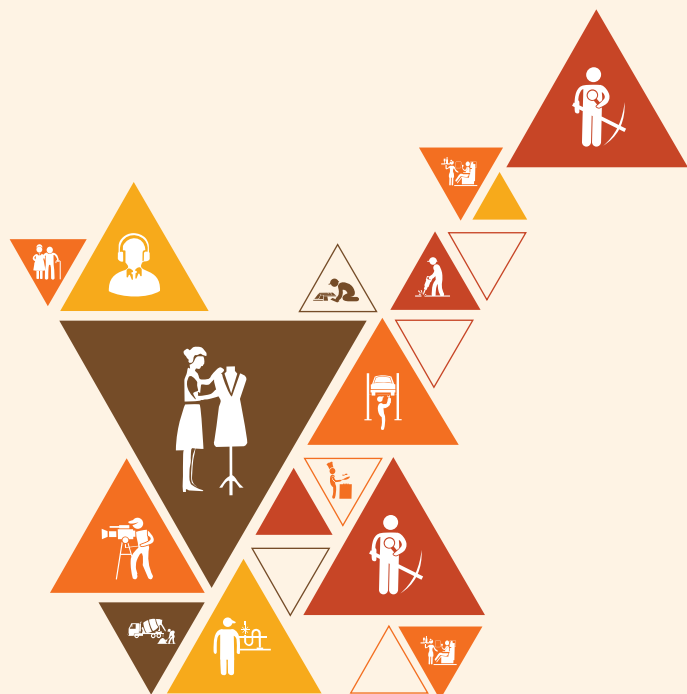


<https://www.skillindiadigital.gov.in/content/list>

Employability Skills



### Annexure III: List of QR Codes Used in PHB



## Annexure I

### Training Delivery Plan

Training Delivery Plan			
Program Name:	Cold Storage Technician		
Qualification Pack Name & Ref. ID	FIC/Q7004 V3.0		
Version No.	3.0	Version Update Date	30/09/2021
Pre-requisites to Training (if any)	NA		
Training Outcomes	<p><b>By the end of this program, the participants will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Prepare work area for cold storage of food product.</li> <li>2. Handle cold storage facility.</li> <li>3. Perform documentation and record keeping related to cold storage.</li> <li>4. Demonstrate the maintenance of hygiene and sanitation related to cold storage of food product.</li> </ol>		

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
1	Introduction to the training program and overview of food processing industry	Introduction to Food Processing Industry	<ul style="list-style-type: none"> <li>• Define Food Processing.</li> <li>• List the various sub sectors of food processing industry.</li> <li>• Describe the roles &amp; responsibilities of a cold storage technician</li> <li>• List the various units within a cold storage plant.</li> </ul>	FIC/N7010 v1.0 KU1, Ku2, ku3, KU4, KU5	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	White board/Chart papers, marker	4 Theory (04:00) Practical (0:00)
2	Prepare and maintain work area and refrigeration equipment	Sanitation and Cleaning Procedures for Food Processing and Storage Facilities	<ul style="list-style-type: none"> <li>• Identify the approved sanitizers and appropriate cleaning equipment for maintaining cleanliness in a food processing work area.</li> </ul>	FIC/N7010 v1.0 PC1, PC2, KU8, KU9, KU10	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Laptop, white board, marker, chart papers, projector, trainer's guide, student handbook, Compressor, Condenser, Evaporator, Fans, Sensors, Thermostat, Humidity Meter,	

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> <li>Demonstrate the correct procedure for disinfecting equipment/ tools in a food processing environment using approved sanitizers.</li> <li>Demonstrate the correct procedure for cleaning equipment used in food storage facilities using approved sanitizers following SOP.</li> </ul>			Protective Gloves, Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual	8 Theory (04:00) Practical (04:00)
		<b>Hygienic and safe work area</b>	<ul style="list-style-type: none"> <li>Summarize the importance of maintaining a hygienic and safe work area in food processing and identify the risks associated with poor sanitation.</li> </ul>	FIC/N7010 v1.0 PC1, PC2, KU8, KU9, KU10			8 Theory (02:00) Practical (06:00)
		<b>Various food safety standards and regulations</b>	<ul style="list-style-type: none"> <li>Analyse the various food safety standards and regulations as per FSSAI and determine their impact on the food processing industry.</li> </ul>	FIC/N7010 v1.0 PC1, PC2, KU8, KU9, KU10			8 Theory (02:00) Practical (06:00)
		<b>Waste Disposal</b>	<ul style="list-style-type: none"> <li>Explain how to dispose waste materials as per defined SOPs and industry requirements.</li> </ul>	FIC/N7010 v1.0 PC3			8 Theory (02:00) Practical (06:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		<b>Equipment used in Food Storage</b>	<ul style="list-style-type: none"> <li>Explain the importance of regularly checking the working and performance of equipment used in food storage facilities, such as compressors, condensers, evaporators, fans, sensors, thermostats, and humidity meters.</li> </ul>	FIC/N7010 v1.0 PC4, PC5, PC6, KU11, KU12			8 Theory (02:00) Practical (06:00)
		<b>Supplier/manufacturer's Instructions</b>	<ul style="list-style-type: none"> <li>Summarize the supplier/manufacturer's instructions related to the cleaning and maintenance of equipment used in food storage facilities.</li> </ul>	FIC/N7010 v1.0 PC4, PC5, PC6, KU11, KU12			8 Theory (02:00) Practical (06:00)
		<b>Repairs/faults in Equipment</b>	<ul style="list-style-type: none"> <li>Analyse minor repairs/faults in equipment used in food storage facilities and recommend appropriate corrective actions.</li> </ul>	FIC/N7010 v1.0 PC4, PC5, PC6, KU11, KU12			8 Theory (02:00) Practical (06:00)
<b>3</b>	<b>Handle cold storage facility for storing food</b>	<b>Introduction to Refrigeration Systems</b>	<ul style="list-style-type: none"> <li>Define what a refrigeration system is and how it works</li> <li>Identify the function of each component in a refrigeration system</li> <li>Interpret technical drawings, inspect the location for setting up refrigeration unit, install condensing unit, mount evaporation coil evaporator</li> </ul>	FIC/N7011 v1.0 PC1, KU1, KU31, KU32	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, Compressor, Condenser, Evaporator, Fans, Sensors, Thermostat, Humidity Meter, Protective Gloves,	8 Theory (04:00) Practical (04:00)



SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		<b>Installation of Refrigeration System</b>	<ul style="list-style-type: none"> <li>List the industry refrigeration guidelines and applicable codes for installing a refrigeration system</li> <li>Explain the importance of following industry guidelines and codes during installation</li> <li>Demonstrate proper installation of piping and wiring connections for a refrigeration system</li> </ul>	FIC/N7011 v1.0 PC2		Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual	8 Theory (04:00) Practical (04:00)
		<b>Temperature Sensing in Cold Storage Facility</b>	<ul style="list-style-type: none"> <li>Describe the importance of temperature sensors in a cold storage facility</li> <li>Explain the types and placement of temperature sensors used in a cold storage facility</li> <li>Determine the number of temperature sensors required for a cold storage facility and place them in relevant locations for precise readings</li> </ul>	FIC/N7011 v1.0 PC3			7 Theory (03:00) Practical (04:00)
		<b>Charging Refrigerant into the System</b>	<ul style="list-style-type: none"> <li>Explain the importance of charging refrigerant to the proper level</li> <li>Charge refrigerant from supply tank to compressor while determining charging level through weight and sight glass indication</li> </ul>	FIC/N7011 v1.0 PC4, KU11			7 Theory (03:00) Practical (04:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		<b>Pre-start up Checks</b>	<ul style="list-style-type: none"> <li>Identify the elements of pre-start up checks</li> <li>Explain the importance of pre-start up checks for a refrigeration system</li> <li>Perform pre-start up checks to ensure proper operation of a refrigeration system</li> </ul>	FIC/N7011 v1.0 PC5			7 Theory (03:00) Practical (04:00)
		<b>Start-ing the Re-frig-eration System</b>	<ul style="list-style-type: none"> <li>Explain the importance of checking compressor discharge and suction pressures</li> <li>Start the refrigeration system and check compressor discharge and suction pressures, monitor compressor oil level and add oil if necessary, and check voltage and amperage at compressor terminals</li> </ul>	FIC/N7011 v1.0 PC6, PC7			7 Theory (03:00) Practical (04:00)
		<b>Check-ing the Op-eration of Fans and Cool-ing Tow-er</b>	<ul style="list-style-type: none"> <li>Identify the elements of checking the operation of fans and cooling tower</li> <li>Show how to set the defrost control/timer clock to required time and verify the defrost initiation settings,</li> </ul>	FIC/N7011 v1.0 PC8, PC9, PC10			7 Theory (03:00) Practical (04:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> <li>• Show how to set temperature control to desired temperature range</li> <li>• Check the functioning and performance of sensors and temperature measuring device</li> </ul>				
		<b>Setting Storage Parameters</b>	<ul style="list-style-type: none"> <li>• Define what storage parameters are and how they are set</li> <li>• Explain the importance of setting storage parameters for a cold storage facility</li> <li>• Adjust controls to set storage parameters such as temperature and humidity required for the food of the cold storage room/chamber following the storage parameter chart and check readings to ensure set storage parameters has reached or make required adjustments or set controls in the PLC (in case of computerized cold storage units)</li> <li>• Demonstrate the procedure to weigh and check the temperature of food, transfer it to the cold storage room and load in the racks either manually or using forklift following SOP</li> </ul>	FIC/N7011 v1.0 PC11, PC12, PC13, PC14, PC15, PC16, KU4			7 Theory (03:00) Practical (04:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		<b>Monitoring Storage Parameters</b>	<ul style="list-style-type: none"> <li>Identify the elements of monitoring storage parameters</li> <li>Explain the importance of monitoring storage parameters for a cold storage facility</li> <li>Observe temperature and humidity and adjust controls to maintain storage parameters during the entire storage period, check temperature of air and stored food periodically for conformance to specifications and standards, and inspect storage products periodically for decay, mold growth, sprouting, shriveling, etc.</li> </ul>	FIC/N7011 v1.0 PC17, PC18, PC19, PC20, PC21, PC22, PC23, KU4, KU5, KU6, KU7, KU8			8 Theory (03:00) Practical (05:00)
		<b>Inspect, re-pair/replace re-frigeration systems and components</b>	<ul style="list-style-type: none"> <li>Explain the importance of repairing and maintaining a refrigeration system for its efficient operation</li> </ul>	FIC/N7011 v1.0 PC24, PC25, PC26, PC27, PC28, KU9, KU12			8 Theory (03:00) Practical (05:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> <li>Detect refrigerant leak and repair, dismantle, repair and replace faulty components, reassemble components and test for correct operation, and ensure equipment is running efficiently and the required operating conditions are maintained in the cold store chambers for operational requirements</li> </ul>				
		<b>Repairing and Maintaining Re-frigeration System</b>	<ul style="list-style-type: none"> <li>Explain the importance of periodic maintenance of a refrigeration system.</li> <li>List the components of a refrigeration system that require periodic maintenance.</li> <li>Conduct periodic maintenance of a refrigeration system following the standard operating procedure (SOP)</li> <li>Describe the process of washing evaporator coils to remove dust and foreign materials.</li> <li>Check the evaporators for ice accumulation and wash evaporator coils to remove dust and foreign materials.</li> </ul>	FIC/N7011 v1.0 PC29, PC30, PC31, PC32, KU13, KU14, KU15			8 Theory (04:00) Practical (04:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> <li>Lubricate fan motors, replace fan motors if required, check evaporator and condenser fan blades, clean the fan blades, replace worn blades, and tighten the fan set screws.</li> </ul>	FIC/N7011 v1.0 PC29, PC30, PC31, PC32, KU13, KU14, KU15			8 Theory (04:00) Practical (04:00)
		<b>Electrical Components and Refrigerant Line Maintenance</b>	<ul style="list-style-type: none"> <li>Describe the process of checking and replacing damaged wiring and tightening all electrical connections.</li> <li>Check the condition of refrigerant line insulation and replace it if necessary, check the refrigerant level in the system, and ensure no refrigerant leak.</li> </ul>	FIC/N7011 v1.0 PC33, PC34, PC35, KU13, KU14, KU15			8 Theory (04:00) Practical (04:00)
4	<b>Complete documentation and record keeping related to the cold storage facility</b>	<b>Document and maintain records of stored food in the cold storage facility</b>	<ul style="list-style-type: none"> <li>Demonstrate the correct procedure for documenting and maintaining records of incoming food to a storage facility, including details such as farmer/vendor information, labelling requirements, and storage location within the cold storage unit.</li> </ul>	FIC/N7012 v1.0 PC1, PC2, PC3, PC4, PC5, KU9, KU10, KU15	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, Food safety manual, Log Books	8 Theory (03:00) Practical (05:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> <li>Demonstrate the correct procedure for documenting and maintaining records of outgoing food from a cold storage facility, including details such as actual storage period, quality of food during unloading, and packaging condition.</li> <li>Summarize the importance of maintaining records of observations related to storage in a cold storage facility.</li> <li>Demonstrate the correct procedure for loading details into an ERP system for future reference in a cold storage facility.</li> <li>Analyse how to verify documents and track details in cases of concerns in a cold storage facility to ensure compliance with food safety regulations and standards.</li> </ul>				
		<b>Document and maintain records of storage parameters</b>	<ul style="list-style-type: none"> <li>Demonstrate the correct procedure for documenting and maintaining records of food parameters such as temperature and relative humidity during the storage period in a cold storage facility, following standard operating procedures (SOP).</li> </ul>	FIC/N7012 v1.0 PC6, PC7, PC8, PC9, PC10, KU12, KU13, KU14, KU15			8 Theory (03:00) Practical (05:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> <li>• Demonstrate the correct procedure for documenting and maintaining records of cold storage parameters such as temperature and relative humidity before loading, during storage, and during unloading, following standard operating procedures (SOP).</li> <li>• Evaluate the importance of maintaining records of observations or deviations related to storage parameters and suggest methods for improving the documentation process.</li> <li>• Demonstrate the correct procedure for loading the details of food parameters and cold storage parameters in an ERP system for future reference, following standard operating procedures (SOP).</li> <li>• Analyse the importance of verifying documents and tracking details in cases of concerns related to food and cold storage parameters and suggest methods for improving the verification and tracking process</li> </ul>				



SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		<b>Document and maintain records of maintenance of refrigeration system Part - 1</b>	<ul style="list-style-type: none"> <li>Summarize the information that needs to be documented and maintained for refrigeration systems, including the type of refrigeration unit, refrigerant, quantity of refrigerant used, and details of cooling system components such as compressors, condensers, evaporators, and fans.</li> <li>Demonstrate the correct procedure for recording the operating conditions of a cold storage room by measuring and recording the temperature of food and air in the room, compressor pressure, ice formation, etc.</li> <li>Analyse the importance of maintaining accurate and up-to-date records of technical drawings, refrigeration system details, and cold storage operating conditions, and determine how these records can be used to improve the efficiency and effectiveness of cold storage operations.</li> </ul>	FIC/N7012 v1.0 PC11, PC12, PC13			7 Theory (02:00) Practical (05:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		<b>Document and maintain records of maintenance of refrigeration system Part - 2</b>	<ul style="list-style-type: none"> <li>Summarize the importance of maintaining accurate records and documentation for a refrigeration system, including how it supports future reference and helps identify areas of concern.</li> <li>Demonstrate the correct method of documenting and maintaining records of preventive maintenance, routine checks, inspections, faults identified, repairs, replacements, refrigerant leak, recharge, quantity and kind (new, reused or recycled) of refrigeration system and components, following standard operating procedures.</li> <li>Demonstrate the correct procedure for documenting and maintaining records of a refrigeration system, following the organization's standard operating procedures (SOPs).</li> <li>Demonstrate the correct method of loading details into an ERP system followed by the organization for future reference.</li> </ul>	FIC/N7012 v1.0 PC14, PC15, PC16, PC17, KU15			7 Theory (02:00) Practical (05:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> <li>Evaluate the importance of verifying documents and tracking details in cases of concerns related to the refrigeration system and recommend appropriate corrective actions.</li> </ul>				
5	IT Orientation	Basic Functionalities of Computer	<ul style="list-style-type: none"> <li>State the basic functionalities of the computer to perform day to day activities.</li> <li>Demonstrate the standard techniques used to operate a computer.</li> </ul>	FIC/N7012 v1.0 KU14	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook	8 Theory (03:00) Practical (05:00)
		Applications used for Recording Information	<ul style="list-style-type: none"> <li>List the various applications used in recording information.</li> </ul>	FIC/N7012 v1.0 KU9			8 Theory (03:00) Practical (05:00)
		Introduction to ERP	<ul style="list-style-type: none"> <li>Describe ERP</li> </ul>	FIC/N7012 v1.0 KU15			7 Theory (02:00) Practical (05:00)
		Using ERP Software	<ul style="list-style-type: none"> <li>Show how to use an ERP software for recording information.</li> </ul>	FIC/N7012 v1.0 KU15			7 Theory (02:00) Practical (05:00)
6	Food Safety, Hygiene and Sanitation	Personal Hygiene and Equipment Maintenance	<ul style="list-style-type: none"> <li>Summarize the measures for ensuring personal safety by using appropriate equipment such as gloves, hairnets, masks, earplugs, goggles, and shoes.</li> </ul>	FIC/N9003 v1.0 PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8, PC9, KU8, KU9, KU10, KU11, KU12, KU13, KU14, KU15	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, Protective gloves,	8 Theory (03:00) Practical (05:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> <li>Explain the importance of complying with food safety and hygiene procedures in a food processing organization.</li> <li>Demonstrate the correct procedure for inspecting raw materials, ingredients, finished products, etc. for compliance with physical, chemical, and microbiological parameters.</li> <li>Demonstrate the correct procedure for inspecting raw materials, ingredients, finished products, etc. for compliance with physical, chemical, and microbiological parameters.</li> <li>Demonstrate the correct procedure for inspecting raw materials, ingredients, finished products, etc. for compliance with physical, chemical, and microbiological parameters.</li> </ul>			head caps, aprons, safety goggles, safety boots, mouth covers, sanitizer, food safety manual, log-books etc.	

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		<b>Compliance and Industry Standards</b>	<ul style="list-style-type: none"> <li>Identify the industry standards such as GMP and HACCP and explain the product recall process.</li> <li>Summarize the types of hazards such as physical, chemical, and biological hazards and the measures to control and prevent them.</li> <li>Demonstrate the correct procedure for identifying, documenting, and reporting problems such as rodents and pests to management.</li> <li>Analyse the importance of workplace checklist audits before and after work to ensure safety and hygiene.</li> <li>Demonstrate the procedures for documenting and maintaining raw material, packaging material, process, and finished products for the credibility and effectiveness of the food safety control system.</li> </ul>	FIC/N9003 v1.0 PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8, PC9, KU8, KU9, KU10, KU11, KU12, KU13, KU14, KU15			8 Theory (03:00) Practical (05:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		<b>Perform Packag-ing</b>	<ul style="list-style-type: none"> <li>Explain the importance of packaging products in appropriate packaging materials, labelling, and storing them in designated areas, free from pests, flies, and infestations.</li> <li>Summarize the measures for following housekeeping practices by having designated areas for materials and tools.</li> <li>Conduct workplace checklist audits before and after work to ensure safety and hygiene</li> </ul>	FIC/N9003 v1.0 PC10, PC11, PC12			7 Theory (02:00) Practical (05:00)
		<b>Applying food safety practices for storage</b>	<ul style="list-style-type: none"> <li>Apply the criteria of smell, appearance, taste, and touch to determine the quality of produce and take appropriate measures to prevent spoilage.</li> <li>Demonstrate storing of different varieties of produce, chemicals, gases separately to prevent cross contamination.</li> </ul>	FIC/N9003 v1.0 PC13, PC14, PC15, PC16, KU17, KU18, KU19, KU20, KU21, KU22			7 Theory (02:00) Practical (05:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> <li>Demonstrate the correct procedure for labelling and storing produce, chemicals, and gases in designated storage areas according to safe food practices.</li> <li>Analyse the importance of stock rotation based on storage chemicals on first expiry first out (FEFO) / first in first out (FIFO) principles and demonstrate the correct procedure for implementing these principles in a food storage facility.</li> </ul>				
Total							Theory Duration 90:00  Practical Duration 150:00
OJT							00:00
Employability Skills (DGT/VSQ/N0101)							30:00
Total Duration							Theory + Practical + OJT + ES 270:00

## Annexure II

### Assessment Criteria

#### CRITERIA FOR ASSESSMENT OF TRAINEES

Assessment Criteria for Cold Storage Technician	
Job Role	Cold Storage Technician
Qualification Pack	FIC/Q7004 V3.0
Sector Skill Council	Food Processing

S. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC. The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
2	Assessment will be conducted for all compulsory NOS, as well as the selected elective NOS/set of NOS.
	OR
4	Assessment will be conducted for all compulsory NOS, as well as the selected optional NOS/set of NOS.
5	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below)
6	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
7	To pass the Qualification Pack, every trainee should score a minimum of 70% of aggregate marks to successfully clear the assessment.
8	In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack

Assessable Outcomes	Assessment Criteria for Outcomes	Marks Allocation	
		Theory	Practical
<b>FIC/N7010: Prepare and maintain work area and refrigeration equipments</b>	PC1. clean and maintain the cleanliness of the work area using approved sanitizers and keep it free from dust, waste, flies and pests	10	15
	PC2. ensure that the work area is safe and hy-gienic for food processing	3	7
	PC3. dispose waste materials as per defined SOPs and industry requirements	5	10
	PC4. check the working and performance of all equipments used in storage facility such as compressor, condenser, evaporator, fans, sensors, thermostat, humidity meter, etc.	7	8
	PC5. clean the equipments used with approved sanitizers following SOP	5	15
	PC6. attend minor repairs/faults of all equipments, if required	5	10
	<b>NOS Total</b>	<b>35</b>	<b>65</b>
<b>FIC/N7011: Handle cold storage facility for storing food</b>	PC1. interpret technical drawings, inspect the location for setting up refrigeration unit, install condensing unit, mount evaporation coil evaporator	1	2
	PC2. install piping following industry refrigeration guidelines and applicable codes to ensure proper operation of the refrigeration system, check all wiring connections	1	2



PC3. calculate the number of temperature sensors required for the cold storage facility, identify location to place the sensors and place in relevant locations within the cold storage facility to obtain precise read-ing	1	2
PC4. charge refrigerant from supply tank to com-pressor determining charging level through weight and sight glass indication	1	2
PC5. perform pre-start up checks by verifying sufficient refrigerant is charged, electrical connec-tions are tight, wiring and piping are properly routed and secured, compressor mounting bolts are proper, fan motors and mounting brackets are tight, condensing unit base and evaporator coil are properly secured	1	2
PC6. start the refrigeration system and check the compressor discharge and suction pressures to en-sure they are in the normal operating range, check the liquid line sight glass for proper refrigerant charge, monitor the compressor oil level and add oil if necessary to maintain required level	1	2
PC7. check the voltage and amperage at the com-pressor terminals, check the piping and electrical connections for vibration	1	2
PC8. check fans on the evaporator coil and con-densing unit (for air-cooled condenser) to ensure they are operational and turning in the correct di-recton, check cooling tower (for water-cooled con-denser), ensure there is no refrigerant leakag	1	2
PC9. set the defrost control/timer clock to required time and verify the defrost initiation settings, set temperature control to desired temperature range	1	2
PC10. check the functioning and performance of sen-sors and temperature measuring device	1	2
PC11. read and understand the work order from the supervisor	1	2
PC12. check all the features of the cold stor-age facility, operation of the cooling equip-ment and ensure readiness	1	2
PC13. calibrate temperature and humidity measuring instruments of the storage facility	1	2
PC14. receive food for storage, check the quality of product to be stored in cold storage facility through physical parameters, check the packaging of the product	1.5	1.5
PC15. adjust controls to set storage parameters such as temperature and humidity required for the food of the cold storage room/chamber following the storage parameter chart, check readings to ensure set storage parameters has reached or make re-quired adjustments or set controls in the plc and monitor system (in case of computerized cold stor-age units)	2	3
PC16. weigh and check the temperature of food, transfer it to the cold storage room and load in the racks either manually or using forklift following SOP	1	2
PC17. check the temperature in cold storage room between the cartons on a pallet or between pack-ages inside a carton to ensure proper air circula-tion	1	2
PC18. observe temperature and humidity and ad-justs controls to maintain storage parameters dur-ing the entire storage period	1	2
PC19. check temperature of air and stored food peri-odically for conformance to specifications and stand-ards	1	2
PC20. inspect the storage products periodically for decay, mold growth, sprouting, shriveling, etc	1	2
PC21. unload stored product immediately after specified storage period and check temperature and weight	1	2
PC22. check the quality of the food from the stor-age facility through product temperature, and check for shriveling of agricultural produce, freez-er burns, mold growth, deterioration, etc	1.5	1.5

	PC23. report any malfunction to the supervisor and implement the suggested corrective action immediately	1	1
	PC24. conduct periodic inspection of refrigeration system and components for correct operation, observe operating condition and need for repair or adjustment	1	2
	PC25. detect refrigerant leak through system pressure, temperature, recharge volume liquid level etc, to repair recover refrigerant, inspect, rectify and recharge the refrigerant	1	2
	PC26. identify malfunction of components, dismantle, repair and replace faulty components	1	2
	PC27. reassemble components, test for correct operation, charge system with correct refrigerant, ensure correct operation of the equipment	1	2
	PC28. ensure equipment is running efficiently and the required operating conditions are maintained in the cold store chambers for operational requirements	1.5	1.5
	PC29. ensure periodic maintenance of refrigeration system and components following SOP	0.5	0.5
	PC30. check the evaporators for ice accumulation/proper defrosting, wash evaporator coils to remove dust and foreign materials drawn into the fins	0.5	1.5
	PC31. check evaporator and condenser fan blades for fractures, clean the fan blades, replace worn blades and tighten the fan set screws, lubricate fan motors, replace fan motor if required	0.5	1.5
	PC32. check for the operation of defrost controls, ensure defrost heaters are in the correct position for maximum heat transfer to the evaporator coil, check the voltage at each heater terminal and ensure heater terminals are in good condition	0.5	1.5
	PC33. remove foreign materials from the drain pan, check the drain line heater (in case of maintaining freezing temperature)	0.5	0.5
	PC34. in compressor unit, replace worn condenser motor, check all electrical components and replace damaged wirings and tighten all electrical connections, check and ensure functioning of pressure controls and safety controls, check oil level, ensure working of solenoid valves, check operation of cold room temperature thermostat and clean condenser periodically	1	3
	PC35. check condition of refrigerant line insulation and replace if necessary, check refrigerant level in the system, ensure no refrigerant leak	1	2
	<b>NOS Total</b>	<b>35</b>	<b>65</b>
<b>FIC/N7012: Complete documentation and record keeping related to the cold storage facility</b>	PC1. document and maintain records of all incoming food to the storage room/facility, types and varieties of food, weight of food, farmer/vendor details, grown area / geographical location, receiving date, label details such as date of manufacture, date of expiry, quality parameters, date of loading in cold storage facility, intended storage period, outgoing date, type of packaging, loading pattern, storage location within the cold storage unit, etc. following SOP	6	4
	PC2. document and maintain records of all outgoing food from the cold storage facility such as type and varieties of food, weight of food, actual storage period, losses from incoming to outgoing period, quality of food during unloading from cold storage unit, packaging condition, etc. following SOP	3	2
	PC3. maintain record of observations (if any) related to storage	3	2
	PC4. load the details in ERP system for future reference	3	2
	PC5. verify the documents and track details in cases of concerns	6	4






	PC6. document and maintain records of parameters such as temperature, relative humidity of the food before loading in the cold storage facility, during storage period and during unloading from the storage facility for each food stored following SOP	9	6
	PC7. document and maintain records of parameters such as temperature, relative humidity of the cold storage room/facility before loading, during storage and during unloading following SOP	6	4
	PC8. maintain record of observations or deviations (if any) related to storage parameters	3	2
	PC9. load the details in ERP system for future reference	3	2
	PC10. verify the documents and track details in cases of concerns	3	2
	PC11. document and maintain records of the technical drawings of cold storage room/chamber, refrigeration system and components, electrical lines, etc.	2	1
	PC12. document and maintain records of refrigeration system such as type of refrigeration unit, type of refrigerant, quantity of refrigerant used, cooling system followed, component details such as type of compressor, condenser, evaporator, fans etc following SOP	4	3
	PC13. document and maintain records of operating conditions of cold storage room by recording temperature of food and air in the cold storage room/chamber, compressor pressure, ice formation etc	3	2
	PC14. document and maintain records of preventive maintenance, routine checks, inspections, faults identified, repairs, replacements, refrigerant leak, recharge, quantity and kind (new, reused or recycled etc of refrigeration system and components following SOP	2.5	1.5
	PC15. maintain record of observations or deviations (if any)	1.5	1
	PC16. load the details in erp system followed by the organisation for future reference	1.5	1
	PC17. verify the documents and track details in cases of concerns	0.5	0.5
	<b>NOS Total</b>	<b>60</b>	<b>40</b>
<b>FIC/N9003: Food safety, hygiene and sanitation for storage</b>	PC1. comply with food safety and hygiene procedures followed in the organisation	2	3
	PC2. ensure personal hygiene by using of gloves, hairnets, masks, ear plugs, goggles, shoes, etc.	1	5
	PC3. ensure hygienic production of food by inspecting raw materials, ingredients, finished products, etc. for compliance to physical, chemical and microbiological parameters	2	3
	PC4. pack products in appropriate packaging materials, label and store them in designated area, free from pests, flies and infestations	4	6
	PC5. clean, maintain and monitor food processing equipment periodically, using it only for the specified purpose	2	3
	PC6. use safety equipment such as fire extinguisher, first aid kit and eye-wash station when required	4	6
	PC7. follow housekeeping practices by having designated area for materials/tools	2	3
	PC8. follow industry standards such as gmp and haccp and product recall process	4	6
	PC9. attend training on hazard management to understand types of hazards such as physical, chemical and biological hazards and measures to control and prevent them	1	4
	PC10. identify, document and report problems such as rodents and pests to management	1	4







	PC11. conduct workplace checklist audits before and after work to ensure safety and hygiene	1	4
	PC12. document and maintain raw material, packaging material, process and finished products for the credibility and effectiveness of the food safety control system	1	3
	PC13. determine the quality of produce using criteria such as smell, appearance, taste and take immediate measures to prevent spoilage	2	3
	PC14. store different varieties of produce, chemicals, gases separately to prevent cross-contamination	2	3
	PC15. label produce, chemicals, gases and store in designated storage areas according to safe food practices	2	3
	PC16. follow stock rotation based of storage chemicals on first expiry first out (FEFO) / first in first out (FIFO)	4	6
	<b>NOS Total</b>	<b>35</b>	<b>65</b>
<b>DGT/VSQ/N0101: Employability Skills (30 Hours)</b>	Introduction to Employability Skills	1	1
	PC1. understand the significance of employability skills in meeting the job requirements	-	-
	Constitutional values – Citizenship	1	1
	PC2. identify constitutional values, civic rights, duties, personal values and ethics and environmentally sustainable practices	-	-
	Becoming a Professional in the 21st Century	1	3
	PC3. explain 21st Century Skills such as Self-Awareness, Behavior Skills, Positive attitude, self-motivation, problem-solving, creative thinking, time management, social and cultural awareness, emotional awareness, continuous learning mindset etc.	-	-
	Basic English Skills	2	3
	PC4. speak with others using some basic English phrases or sentences	-	-
	Communication Skills	1	1
	PC5. follow good manners while communicating with others	-	-
	PC6. work with others in a team	-	-
	Diversity & Inclusion	1	1
	PC7. communicate and behave appropriately with all genders and PwD	-	-
	PC8. report any issues related to sexual harassment	-	-
	Financial and Legal Literacy	3	4
	PC9. use various financial products and services safely and securely	-	-
	PC10. calculate income, expenses, savings etc.	-	-
	PC11. approach the concerned authorities for any exploitation as per legal rights and laws	-	-
	Essential Digital Skills	4	6
	PC12. operate digital devices and use its features and applications securely and safely	-	-
	PC13. use internet and social media platforms securely and safely	-	-
	Entrepreneurship	3	5
	PC14. identify and assess opportunities for potential business	-	-
	PC15. identify sources for arranging money and associated financial and legal challenges	-	-

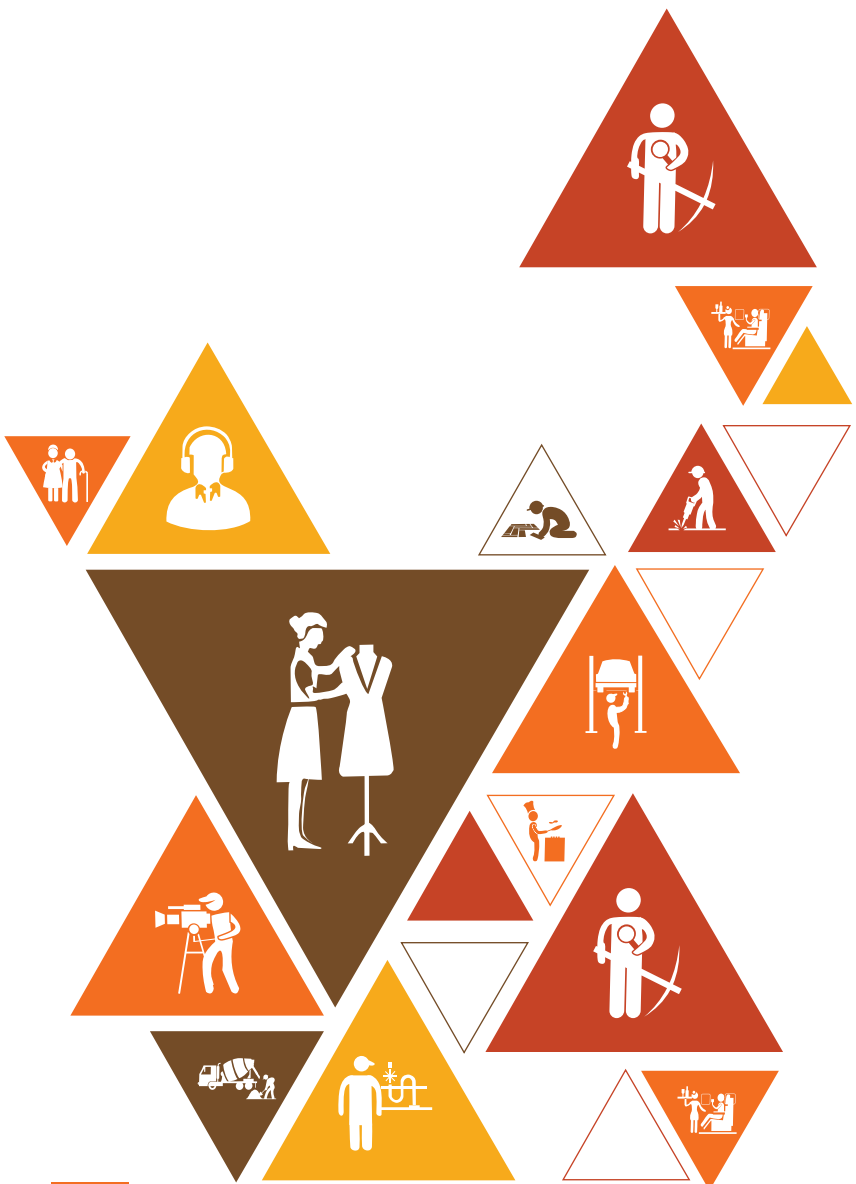
	Customer Service	2	2
	PC16. identify different types of customers	-	-
	PC17. identify customer needs and address them appropriately	-	-
	PC18. follow appropriate hygiene and grooming standards	-	-
	Getting ready for apprenticeship & Jobs	1	3
	PC19. create a basic biodata	-	-
	PC20. search for suitable jobs and apply	-	-
	PC21. identify and register apprenticeship opportunities as per requirement	-	-
	<b>NOS Total</b>	<b>20</b>	<b>30</b>

## Annexure III

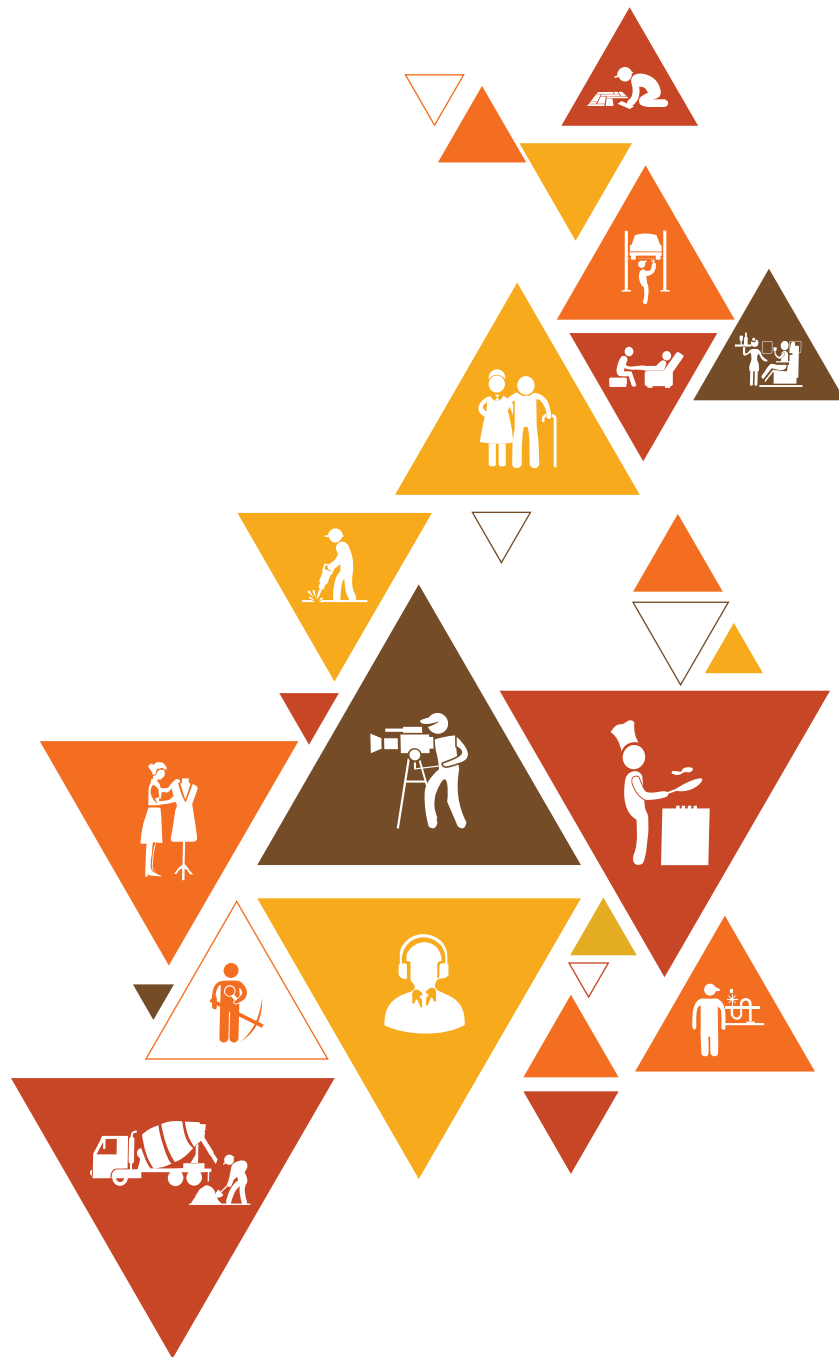
### List of QR Codes Used in PHB

Module No.	Unit No.	Topic Name	Page No. in PHB	URL	QR Code (s)
1. Introduction	UNIT 1.2: Introduction to the Food Processing Industry	1.2.1 Food Processing	11	<a href="https://www.youtube.com/watch?v=J-2EiMVNtpM">https://www.youtube.com/watch?v=J-2EiMVNtpM</a>	 Overview of food processing industry
	UNIT 1.4: Attributes of a Cold Storage Technician	1.4.1 Role and Responsibilities	11	<a href="https://www.youtube.com/watch?v=Rkym0HNt9xE">https://www.youtube.com/watch?v=Rkym0HNt9xE</a>	 Roles and Responsibilities
	UNIT 1.1: Introduction to the Training Programme	1.1.1 Purpose and Benefits of the Training Programme	11	<a href="https://www.youtube.com/watch?v=Zl1u2C-yhIY">https://www.youtube.com/watch?v=Zl1u2C-yhIY</a>	 Orientation video
2. Food Safety, Hygiene and Sanitation	UNIT 2.1: Sanitation and Hygiene	2.1.1 Personal Sanitation	27	<a href="https://www.youtube.com/watch?v=WYosZ4z-ru5Y&amp;t=101s">https://www.youtube.com/watch?v=WYosZ4z-ru5Y&amp;t=101s</a>	 Introduction to food safety
	UNIT 2.3: Good Manufacturing Practices (GMP)	2.3.1 Good Manufacturing Practices (GMP)	27	<a href="https://www.youtube.com/watch?v=RS4A-uczS6E&amp;t=552s">https://www.youtube.com/watch?v=RS4A-uczS6E&amp;t=552s</a>	 Introduction to GMP, GHP & FSMS

Module No.	Unit No.	Topic Name	Page No. in PHB	URL	QR Code (s)
3. Prepare and Maintain Work Area and Refrigeration Equipments	UNIT 3.1: Equipment used in Re-frigeration Process	3.1.1 Equipment Used in the Refrigeration Process	45	<a href="https://www.youtube.com/watch?v=uhq6R6qKNZM">https://www.youtube.com/watch?v=uhq6R6qKNZM</a>	 Overview of controlled atmosphere storage
		3.1.1 Equipment Used in the Refrigeration Process	45	<a href="https://www.youtube.com/watch?v=6nzC8DIhwyU">https://www.youtube.com/watch?v=6nzC8DIhwyU</a>	 Machine and equipments used in cold storage
4. Handle Cold Storage Facility for Storing Food	UNIT 4.4: Storage of Food in Cold Storage	4.4.1 Storage of Food in Cold Storage	67	<a href="https://www.youtube.com/watch?v=_osRXOAWLYQ">https://www.youtube.com/watch?v=_osRXOAWLYQ</a>	 Raw material Storage and warehousing
	UNIT 4.1: Basic Principles of Refrigeration	4.1.1 Basic Principles of Refrigeration	67	<a href="https://www.youtube.com/watch?v=GwGeTWY-10oY&amp;t=16s">https://www.youtube.com/watch?v=GwGeTWY-10oY&amp;t=16s</a>	 Basic storage and transportation
5. Complete Documentation and Record Keeping Related to Cold Storage Facility	UNIT 5.1: Documentation and Record Keeping	5.1.2 How to Keep Records?	74	<a href="https://www.youtube.com/watch?v=kcpGIHBpphA">https://www.youtube.com/watch?v=kcpGIHBpphA</a>	 Audit, Documentation and Record keeping
Employability Skills				<a href="https://www.skillindiadigital.gov.in/content/list">https://www.skillindiadigital.gov.in/content/list</a>	









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