Animal production level IV

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Module Title: - Facilitating and Organizing Animal Products and By-products Handling Systems

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LG #43	LO #1- Identify animal products and by products handling requirements

Instruction sheet

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

- Comparing available animal products and by products handling system
- Measuring and recording maximum peak flow of animal products and by products delivery
- Identifying and complaining relevant legislation including OHS and human health requirements
- Identifying handling system requirements
- Establishing farm animal products and by products entry temperature and other critical design considerations
- Making materials and equipment selection
- Checking suitable PPE

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

- Compare available animal products and by products handling system
- Measure and record maximum peak flow of animal products and by products delivery
- Identify and complain relevant legislation including ohs and human health requirements
- Identify handling system requirements
- Establish farm animal products and by products entry temperature and other critical design considerations

- Make materials and equipment selection
- Check suitable PPE

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, ask your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Comparing available animal products and by products handling system

1.1. Introduction

Meat, fat and other carcass parts used as raw materials for the manufacture of processed meat products are mainly derived from the domesticated animal species cattle, pigs and poultry and to a lesser extend from buffaloes, sheep and goats. In some regions other animal species such as camels, yaks, horses and game animals are used as meat animals but play only a minor role in meat processing.

Meat can be defined as “the muscle tissue of slaughter animals”. The other important tissue used for further processing is fat. Other edible parts of the slaughtered animal and often used in further processing are the internal organs1 (tongue, heart, liver, kidneys, lungs, diaphragm, esophagus, intestines) and other slaughter byproducts (blood, soft tissues from feet, head).

Animal Product

Any material derived from the body of an animal. Examples are fat, flesh, blood, milk, eggs, and lesser known products such as isinglass and rennet. The most obvious products of animals are edible products (“meat”) which are intended for human consumption (e.g. carcasses, offal, etc.).

Animal by-products

Parts of an animal which are not intended for human consumption are animal by-products. These can include parts of animals which are perfectly fit for human

consumption but which are not intended for human consumption, such as heads, feet and some offal.

Animal by-products are the parts of a slaughtered animal that are not directly consumed by humans, including dead on farm animals and catering waste (i.e. waste food originating from restaurants, catering facilities and kitchens) that contains or has been in contact with meat products, whether cooked or uncooked. Some of these products are used in animal proteins like meat-and-bone-meal, fats, gelatin, collagen, pet food and other technical products, such as glue, leathers, soaps, fertilizers etc. The alternative is their destruction, most often by incineration.

A byproduct may be defined as a product of commercial value produced during the manufacture of a main product. During the processing and conversion of milk into various milk products some byproducts are also generated. Skim milk, buttermilk, ghee residue and whey are the main dairy byproducts. Separation of milk for obtaining cream results in skim milk, separation of butter from cream results in buttermilk, ghee residue is that fraction of cream or butter that is left out when they are converted into ghee. Whey is the watery portion obtained during the manufacture of cheese, casein, etc.

Animal by-products are entire animal bodies, parts of animals or products of animal origin that are not intended for human consumption. These include:

- Animal carcasses and parts of animal carcasses - including fish
- Digestive tract content
- Manure from farmed animals, e.g. Pigs, cattle and chickens
- Ova, embryos and semen which are not intended for breeding purposes
- Blood, hides, skins, hooves and horns
- Shellfish and crustacean waste
- Feathers, wool, hair and fur
- Food waste of animal or fish origin no longer intended for human consumption - including eggs, milk and cooking oil used to prepare animal products.

Meat, fish and other material from animals become animal by-products when the material is no longer intended for human consumption. This is the case even if the material is still edible.

Animal by-product controls do not generally apply to:

- Raw pet food sold directly to consumers
- Liquid milk and colostrum disposed of or used on the farm where it was produced
- Wild animals that are not suspected of carrying an infectious disease
- Excrement from domestic pets, zoo or circus animals, horse stables or wild animals, e.g. pigeon droppings
- Catering waste, unless it is to be used as animal feed, is going to a composting or biogas plant, or is from international transport, i.e. from aircraft or ships operating outside the European Union.

Terminologies

Abattoir Any establishment where specified animals are slaughtered and dressed for human consumption and that is approved, registered and/or listed by the competent authority for such purposes.

Ante-mortem inspection - Any test conducted by competent person on live animals for the purpose of judgment of safety and suitability and disposition.

Candling Examining the interior condition of an egg and the integrity of the shell by rotating or causing the egg to rotate in front of or over a light source that illuminates the contents of the egg.

Carcass The body of an animal after dressing.

Condemned Inspected and judged by a competent person, or otherwise determined by the competent authority, as being unsafe or unsuitable for human consumption and requiring appropriate disposal.

Contaminant Any biological or chemical agent, foreign matter, or other substance not intentionally added to food that may compromise food safety or suitability.

Disease or defect any abnormality affecting safety and/or suitability.

Dressing is the progressive separation of the body of an animal into a carcass and other edible and inedible parts.

Egg product All, or a portion of, the contents found inside eggs separated from the shell, with or without added ingredients, intended for human consumption.

Equivalence The capability of different meat hygiene systems to meet the same food safety and/or suitability objectives.

Establishment A building or area used for performing meat hygiene activities that is approved registered and/or listed by the competent authority for such purposes.

Fresh meat is that apart from refrigeration has not been treated for the purpose of preservation other than through protective packaging and which retains its natural characteristics.

Good Hygienic Practice (GHP) all practices regarding the conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain.

Organoleptic inspection is using the senses of sight, touch, taste and smell for identification of diseases and defects.

Post-mortem inspection any procedure or test conducted by a competent person on all relevant parts of slaughtered/killed animals for the purpose of judgment of safety and suitability and disposition.

Quality assurance (QA) All the planned and systematic activities implemented within the quality system and demonstrated as needed, to provide adequate confidence that an entity will fulfill requirements for quality.

Quality assurance (QA) system the organizational structure, procedures, processes and resources needed to implement quality assurance.

Raw meat Fresh meat, minced meat or mechanically separated meat.

Raw milk (as defined in Codex General Standard for the Use of Dairy Terms) which has not been heated beyond 40ºC or undergone any treatment that has an equivalent effect.

Ready-to-Eat (RTE) Products that are intended to be consumed without any further biocidal steps.

Risk-based Containing any performance objective, performance criterion or process criterion developed according to risk analysis principles.

Shelf life is the period during which the product maintains its microbiological safety and suitability at a specified storage temperature and, where appropriate, specified storage and handling conditions.

Table egg an egg destined to be sold to the end consumer in its shell and without having received any treatment significantly modifying its properties.

1.2. Comparing available animal products and by products handling system

1.2.1. Milk products and by products handling system

The principles of preservation are: the raw milk is pasteurized to destroy most enzymes and contaminating bacteria fermentation by lactic-acid bacteria increases the acidity which inhibits the growth of food-poisoning and spoilage bacteria the moisture content is lowered and salt is added to inhibit bacterial and mold growth.

While most smallholder farmers do not have cooling facilities, it is important to cool milk and store it at as low a temperature as is practically possible if it cannot be delivered within 2–3 hours after milking.

This is particularly important for evening milk or where morning milk cannot be transported to the milk collection point within 2–3 hours. Simple means of cooling, such as immersing milk cans in ice blocks or cold water in a trough, are better than leaving the milk un-cooled. Where available, domestic refrigerators may be used but avoid freezing milk as this destabilizes the fat. The lower the temperature the slower the rate of bacterial growth

The perishable nature of milk

Transportation of milk constitutes a vital link between producers and consumers in the milk marketing chain. In an industry that is dominated by the informal sector, this function is carried out by thousands of itinerant milk traders and some specialized transporters. Given that milk is a very perishable product, milk transporters need to understand the need to observe high standards of hygiene, speedy transport and careful handling of milk. These basic requirements are necessary to minimize losses due to milk spoilage, avoid contamination of milk by pathogens and ensure a profit table milk transportation business. Here are some factors that can influence the quality of milk before and during transportation:

- Type of breed
- Contamination

- Storage temperature
- Excessive storage time
- Exposure to light
- Chemical contamination
- Excessive agitation

1.2.2. **Meat products and by products handling system**

In general, meat is composed of water, fat, protein, minerals and a small proportion of carbohydrate. The most valuable component from the nutritional and processing point of view is protein.

Protein contents and values define the quality of the raw meat material and its suitability for further processing. Protein content is also the criterion for the quality and value of the finished processed meat products. Table 1 shows the chemical composition of fresh raw and processed meats.

pH of meat

Immediately post-mortem the muscle contains a small amount of muscle specific carbohydrate, called glycogen1 (about 1%), most of which is broken down to lactic acid in the muscle meat in the first hours (up to 12 hours) after slaughtering. This biochemical process serves an important function in establishing acidity (low pH) in the meat.

The so-called glycolytic cycle starts immediately after slaughter in the muscle tissue, in which glycogen, the main energy supplier to the muscle, is broken down to lactic acid. The buildup of lactic acid in the muscle produces an increase in its acidity, as measured by the pH. The pH of normal muscle at slaughter is about 7.0 but this will decrease in meat. In a normal animal, the ultimate pH (expressed as pH24 = 24 hours after slaughter) falls to around pH 5.8-5.4. The degree of reduction of muscle pH after slaughter has a significant effect on the quality of the resulting meat.

The pH is also important for the storage life of meat. The lower the pH, the lesser favorable conditions for the growth of harmful bacteria. Meat of animals, which had depleted their glycogen reserves before slaughtering (after stressful transport/handling in holding pens) will not have a sufficient fall in pH and will be highly prone to bacterial deterioration

Self-check 1	**Written test**

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

Test I Short Answer Questions

1. List all animal products and by products?(8pts)

Test II choose the best Answer

1. Which one of the following is animal by product extracted from animal intestine?(2pts)

   A. Rennet
   B. Ghee
   C. Hides
   D. Wool

2. _____ is the body of an animal after dressing. (2pts)

   A. Fresh meat
   B. Dressing
   C. Carcass
   D. Abattoir

Note: **Satisfactory rating - 12 points** **Unsatisfactory - below 12 points**

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

Information sheet - 2	**Measuring and recording maximum peak flow of animal products and by products delivery**

Delivery performance is measured as a tool for continues improvement. For the greater part of the data collection they are dependent on haulers (exporter) that provides their transport. At present this data collection is done on the basis of bilateral agreement and systems between industry and haulers (transporter) in order to manage transport, loading and unloading properly and save cost and improve accuracy and efficiency. It is a necessity to measure and record the peak flow of product and by product delivery, a routine measurement and recording system will be needed. As consequence, haulers serving several companies are facing different reporting systems, which complicate a structured processing of information.

The standardized delivery performance measurement is based on reporting by exception (although full reporting possibilities are not excluded). This means that the haulers are supposed to record and report each individual shipment that deviates from the industries requirements as an incident. An incident in this respect is any nonconformance in the provision of a transport order/shipment. With the standardized delivery performance measurement it is intended at all data with a company requires for its internal performance rating are passed in full and standardized by the hauler.

Self-check 2	Written test

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

Test I Short Answer Questions

1. What is delivery performance (4pts)?
2. What is standardized delivery performance measurement (4pts)?

Note: **Satisfactory rating - 8 points** **Unsatisfactory - below 8 points**

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

Information sheet - 3	Identifying and complaining relevant legislation including OHS and human health requirements

Category of animal by products

Animal by-products are divided into three categories according to their potential risk to human and animal health. There are different rules for disposing of waste in each category.

All three categories of animal by-products must be kept separate at all times. If material from one category is mixed with material from another category, the whole mixture must be treated as being in the higher risk category.

Category 1 animal by-products

Category 1 is for very high risk material and includes:

- Animals and materials suspected or confirmed to be infected by transmissible spongiform encephalopathies (TSEs), such as scrapie in sheep, or bovine spongiform encephalopathy (BSE) in cattle
- Animals that have been experimented on
- Zoo and pet animal carcasses
- Wild animals suspected of having an infectious disease
- Catering waste from international transport, i.e. Aircraft and ships
- Specified risk material (SRM), i.e. Tissues from cattle, sheep or goats that might be infected with TSEs, or carcasses that have not had SRM removed

- Animal tissue collected when treating waste water from category 1 processing plants.

Category 2 animal by-products

Category 2 is for high risk material and includes:

- Animals that are slaughtered to prevent the spread of disease
- Manure and digestive tract content
- Animals and parts of animals which die by means other than slaughtering, e.g. Fallen stock
- Animal tissue collected when treating waste water from category 2 processing plants.

Category 3 animal by-products

Category 3 is for low risk material and includes:

- Meat and fish from food manufacturers and retailers
- Former foodstuffs of animal origin, or containing products of animal origin - this includes food that is waste due to manufacturing or packaging defects
- Catering waste, other than catering waste from international transport
- Eggs and other by-products that do not show signs of infectious disease
- Milk
- Fish and other sea animals
- Shells
- Hooves, horns and feathers.

Self-check 3	Written test

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

Test I Short Answer Questions

1. List Category 2 animal by-products?(8pts)

Test II choose the best Answer

1. Which Category of animal products is very high risk material for human and animal health? (2pts)
   A. Category 1
   B. Category 2
   C. Category 3

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

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

Information sheet - 4	Identifying handling system requirements

4.1. Identifying handling system requirements

4.1.1. handling system requirements of meat

4.1.1.1. Hygiene facilities

A well-planned, well-executed and controlled cleaning and sanitation program for rooms, machines and equipment is very important to achieve a hygienic standard. Cleaning and sanitation alone, however, will not assure a hygienic standard in production where process hygiene as well as personal hygiene is important factors.

Well-planned working routines may assure a better cleaning standard during processing. For example, cleaning during processing, removal of solid waste and sufficient space in processing rooms are factors which facilitate cleaning.

Adequate personal hygiene assures the overall cleaning process. Deterioration of the cleaning standard may occur if microorganisms are transmitted to well-cleaned surfaces from unwashed hands before processing starts.

Neither process hygiene and personal hygiene nor cleaning and sanitation alone can assure a sufficient hygienic standard but together, if carried out in an optimal manner, they will guarantee a complete hygienic standard.

A. Process hygiene facilities

It is impossible to give an adequate definition of process hygiene because the critical points will vary, depending on:

- processing
- processing buildings (site, size, buildings)
- equipment available
- permanent or non-permanent personnel (working routines, training)
- climatic conditions
- sanitary facilities
- water and energy supplies
- liquid and solid waste disposal

B. Site of buildings for slaughtering and processing

The slaughterhouse should be situated away from residential areas. Access for animals - either by road, rail and/or stock route - must be assured. The slaughterhouse should be located in areas where flooding is impossible.

An abundant supply of potable water as well as adequate facilities for treatment and disposal is important.

The land acquired for the proposed slaughterhouse should be sufficient to permit future expansion as overcrowding of facilities may give sanitation problems.

Where the “slaughterhouse” is more or less an open slaughter place, trees may provide some shade or even be used as a part of the structure. If the slaughterhouse consists of regular buildings the ground should be free of shrubbery or vegetation in close proximity to the structure.

4.1.1.2. Size

There should be a reasonable relationship between the size of slaughter facilities and the number of animals to be killed.

Sufficient space for lair age and tripe and hide treatment is required. The space required for lair age will often depend on local and even climatic conditions. In specific areas it will only be possible to transport the animals in the dry season while slaughtering may only be carried out in the rainy season because of water requirements.

Sufficient space is required to dig pits for condemned animals, compost stacks, lavatories etc., and for disposal of liquid and solid waste.

4.1.1.3. Buildings / facilities

Buildings / facilities should be so constructed that clean and unclean processes and products do not mix.

The floor must be hard, smooth and impervious, sloping sufficiently towards a drain thus allowing cleaning with water.

Walls, if any, may be made of local construction materials. In certain dry areas walls are not necessary. Materials, which can be cleaned by water, are recommended, e.g. stone, lava blocks, bricks or concrete.

Roofs, if any, may be constructed of materials available (tiles, corrugated iron, asbestos or aluminum).

Roofing is recommended:

- To protect and allow the slaughter process to be independent of the weather
- To provide shade and keep down the internal temperature
- To enable the collection of rainwater in water tanks.

4.1.1.4. Equipment

The main principle for equipment such as tables, hooks and machines, etc. should be that it is easy to dismantle or remove to facilitate cleaning and that it should be made of non-corrosive materials.

Essential for the hygienic handling of carcasses and meat is equipment for hoisting the carcasses, when slaughtered. Hoists, when possible, should be preferred to working tables. Procedures assuring a periodical or continuous cleaning of hoists are recommended.

Cleaning and disinfection will often be complicated or impossible because of the complex construction of machines and when choosing and buying machines, hygienic production and possibilities for cleaning and disinfection must be considered.

4.1.1.5. Sanitary facilities

Water points, hoses, sterilizers for hand tools etc. and cleaning equipment must be provided in sufficient numbers.

Sanitary facilities must also include a sufficient number of toilets/latrines and

arrangements for hand-washing or even possibilities for bathing (showering). These facilities must be kept clean and well maintained.

To avoid back-flow from toilets in case of flooding the toilet outlets must be separated from common waste water outlets.

Areas/rooms for resting and eating may be required assuring that food for the personnel and the carcasses/meat cannot be mixed.

4.1.1.6. **Water and energy supplies**

If sufficient water of drinking quality is available, it will be possible to plan processing and cleaning procedures in a way which assures hygienic products. The water supply may be from the premises own well or from the community supply. Working routines should be planned to economize the consumption of water because of waste water disposal.

Energy supplies will be necessary if the slaughterhouse is more or less automatic. Energy supplies will also be necessary for automatic cleaning and could be provided through windmills, biogas production, fuel and electricity and water could also be heated by solar energy.

If water and energy supplies are sufficient it will be the responsibility of the management of the slaughterhouse to see that these supplies are used efficiently and that sufficient water and energy are used for hygienic purposes.

4.1.2. milk handling system requirements

A. Collection, transport and delivery procedures

- Personnel and vehicular access to the place of collection should be adequate for the suitable hygienic handling of milk. In particular, access to the place of collection should be clear of manure, silage, etc.
- Prior to collection, the milk hauler or collection/chilling center operator should check the individual producer's milk to ensure that the milk does not present obvious indications of spoilage and deterioration. If the milk shows indications of spoilage and deterioration, it should not be collected.
- Collection and chilling centers, if employed, should be designed and operated in such a manner that minimizes or prevents the contamination of milk.

- Milk should be collected under hygienic conditions to avoid contamination of milk. In particular, the milk hauler or collection center operator should, where appropriate, take samples in such a way to avoid contamination of the milk and should ensure that the milk has the adequate storage/in-take temperature prior to collection.
- The milk hauler should receive adequate training in the hygienic handling of raw milk.
- Milk haulers should wear clean clothing.
- Milk hauling operations should not be performed by persons at risk of transferring pathogens to milk. Appropriate medical follow-up should be done in the case of an infected worker.
- Milk haulers should perform their duties in a hygienic manner so that their activities will not result in contamination of milk.
- The driver should not enter the stables or other places where animals are kept, or places where there is manure.
- Should driver clothing and footwear be contaminated with manure, the soiled clothes and footwear should be changed or cleaned before work is continued.
- The tanker driver should not enter the processing areas of the dairy plant.

Conditions should be arranged to allow necessary communication with the staff of the dairy, delivery of milk samples, dressing, rest breaks, etc. without direct contact taking place with the dairy processing areas or with staff members involved with processing milk and milk products.

B. Transport time and temperature

- Transport temperature and time should be such that milk is transported to the dairy or to the collection/chilling center in a manner that minimizes any detrimental effect on the safety and suitability of milk.
- The time and temperature conditions for the collection and transport of milk from the farm should be established taking into account the effectiveness of the control system in place during and after processing, the hygienic condition of the milk and the intended duration of storage. In situations where the milk cannot be chilled on the farm, collection and delivery of this milk to a collection center or

processing facility within certain time limits may be required. These conditions may be specified by the manufacturer receiving the milk in collaboration with the milk producer, collector and transporter and the competent authority.

4.1.3. Handling system requirements of Egg

- Collect eggs in an easy to clean container like coated wire baskets or plastic egg flats. This will prevent stains from rusted metal and contamination from other materials which are difficult to clean and disinfect.
- Do not stack eggs too high. If collecting in baskets do not stack eggs more than 5 layers deep. If using plastic flats do not stack more than 6 flats. If you stack eggs too deep you will increase breakage.
- Never cool eggs rapidly before they are cleaned. The egg shell will contract and pull any dirt or bacteria on the surface deep into the pores when cooled. Try to keep the temperature relatively constant until they are washed.
- Wash eggs as soon as you collect them. This helps limit the opportunity of contamination and loss of interior quality.
- Wash eggs with water 10 degrees warmer than the egg. This will make the egg contents swell and push the dirt away from the pores of the egg. If you have extremely dirty eggs, a mild detergent approved for washing eggs can be used. Never let eggs sit in water. Once the temperature equalizes the egg can absorb contaminants out of the water.
- Cool and dry eggs quickly after washing. Store eggs, large end up, at 50-55°F and at 75% relative humidity. If eggs sit at room temperature (75°F) they can drop as much as one grade per day. If fertile eggs are kept at a temperature above 85°F for more than a few hours the germinal disc (embryo) can start to develop. If fertile eggs are kept above 85°F over two days the blood vessels of the embryo may become visible. If eggs are stored properly in their own carton or other stable environment they should hold a quality of Grade A for at least four weeks.

Self-check 4	Written test

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

Test I Short Answer Questions

1. Write the procedures collection, transport and delivery? (6pts)

Test I choose the best answer

1. Which one of the following is correct about egg storage?
   A. Cool and dry eggs quickly after washing
   B. Store eggs large end up
   C. Store eggs at 50-55°F and 75% relative humidity
   D. All

Note: **Satisfactory rating - 8 points** **Unsatisfactory - below 8 points**

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

Information sheet - 5	Establishing farm animal products and by products entry temperature and other critical design considerations

5.1. Establishing farm animal products and by products entry temperature and other critical design considerations

5.1.1. Meat products and by products entry temperature and other critical design considerations

Warm and wet meat provides the ideal conditions for growth of food poisoning and spoilage bacteria. A combination of low temperatures and dry surfaces will inhibit the growth of bacteria and extend shelf life. Bacteria can multiply quickly if meat is stored or transported at too high a temperature or if heat treatment is inadequate. Procedures are needed to minimize the risk of this hazard causing illness to consumers.

Problem	Effect	Possible outcome
Failure to maintain the cold chain	Growth of bacteria on meat; the higher the temperature the faster bacteria can multiply	A source of microbiological contamination resulting in a serious food safety hazard
Inadequate chilling of cooked meat	Growth of bacteria on meat; the higher the temperature the faster bacteria can multiply	Increased chance of contamination of food products by food poisoning bacteria (such as Salmonella)

Inadequate heat treatment	Failure to maintain high enough temperatures for a sufficient time	Heat-resistant food-poisoning or spoilage organisms will not be destroyed resulting in a source of microbiological contamination

Table 1 Examples demonstrating the importance of temperature controls

Fresh Meats, Poultry, and Seafood

These items are the most difficult to store and the most expensive food items sold by the restaurant. When storing meats, poultry, and seafood items, remember the critical control point.

Keep foods 4°C (39°F) or colder, the safe temperature for refrigerated storage.
Keep these factors in mind when storing fresh meats, poultry, and produce:

- All carcass meats should be unwrapped and hung so that air can circulate around them. They should be stored at 1°C to 3°C (34°C to 37°F) in a walk-in refrigerator. Place absorbent paper under the meats for quick cleanup of any unwanted drips.
- Fresh meat must not be kept too long. Boned meat should be kept no longer than three days. Individual cuts should be used within two days, preferably on the day they are cut.
- Individual meat cuts such as steaks, chops, stewing meat, and ground meat should be kept covered on plastic or stainless steel trays at 2°C to 4°C (36°F to 39°F).
- Fresh poultry should be packed in ice and stored in the refrigerator.
- Fresh seafood should be packed in ice, stored at –1°C to 2°C (30°C to 34°F) and used as soon as possible.
- Store raw products on the lower shelves of the refrigerator, below cooked products.

5.1.2. Milk products and by products entry temperature

The dairy industry uses various means and technologies aimed at achieving an extension in product shelf-life.

Some commonly used methods include:

- Heat treatment of fluid milk products for a pre-determined time and temperature
- Acidification by addition of starter culture in the case of cultured dairy products such as yogurt, buttermilk
- Drying of milk concentrate to produce milk or skim milk powder
- Addition of preserving agents such emulsifying salts e.g., phosphates and citrates in shelf-stable processed cheeses

Shelf-life of fluid milk products, for instance, is dependent on various factors, namely:

- Heat treatment (also known as pasteurization), quality of the incoming raw milk
- Additional processes such as micro-filtration
- Filling conditions
- Temperature control
- Packaging technologies.

However, heat treatment remains the primary factor that determines the span of the shelf-life.

C. **Chill raw milk within an hour of milking**

Raw milk is approximately 37-38.5^{o}C as it comes from the cow, and needs to be chilled to 4°C as fast as possible, preferably within an hour of milking since bacteria count doubles every 20 minutes at body temperature.

Chilling the milk fast ensures a longer shelf life and it just tastes better (will have less off flavors) if it is chilled quickly and stays cool. If milk does not stay cool, it will sour and separate.

Rapid cooling inhibits the good lactic-acid bacteria which causes milk to sour and will inhibit the growth of bad bacteria faster. For optimal preservation of milk quality, it should be stirred as it is rapidly chilling, and it should be kept cool during transportation and storage until use.

Fluid milk processors should make every effort to maintain temperatures below 4^{O}F (4^{O}C) and to move product out of storage within 24 hours whenever possible. Storage

tanks used for storage longer than 24 hours must be equipped with a 72-hour temperature recording chart.

D. Fermented dairy products (yoghurt, cheese, buttermilk, sour cream, etc.)

Freezing and storing fermented products needs extra attention. The mother culture or any amount of bulk starters could be kept frozen in sterile containers varying in size from one-half pint to a quart size. Identification and elate of freezing on the containers filled with cultures helps the operator to locate the proper type organisms he needs, and also reduces the chance to use wrong bacteria.

On the average the frozen cultures are good about 8 months if kept below -23^{o}C. Frozen cultures are used in the manufacturing as a number of dairy products such as cultured buttermilk, sour cream, and many types of cheeses.

Celsius	Fahrenheit	Dairy products
7.2°C	45°F	Days of shelf life (freshness) are lost for every degree above 40°F
4.4°C	40°F	Maximum temperature for dairy product storage
1.1° to 3.9°C	34° to 39°F	Safe range of temperatures for dairy product storage
0°C	32°F	Water freezes
-1.1° to -0.6°	C 30° to 31°F	Milk will freeze in a short time
-23.3°C	-10°F	Safe storage of already frozen dairy products (ice cream, frozen yogurt, butter)
-28.9° to -34.4°C	-20° to -30°F	Temperature necessary to rapidly freeze ice cream and other frozen desserts

Table 2 Temperature guide for dairy products storage

5.1.3. Egg products and by products entry temperature

- Collect eggs at least three times daily.
- Slightly soiled eggs can be used for hatching purposes without causing hatching problems, but dirty eggs should not be saved.

- Store eggs in a cool-humid storage area. Ideal storage conditions include a 55 degree F. temperature and 75% relative humidity.
- Alter egg position periodically if not incubating within 4-6 days. Turn the eggs to new position once daily until placing in the incubator.
- Store eggs small end down in an egg carton to keep the air cell stable.
- Date carton so you can use or sell the oldest eggs first and rotate your extra eggs. Try to use or sell all eggs before they are three weeks old.
- Store eggs at 50-55°F and 70-75% relative humidity.
- Never store eggs with materials that have an odor. Eggs will pick up the odors of apples, fish, onions, potatoes and other food or chemicals with distinct odors.

Self-check 5	**Written test**

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

Test I Short Answer Questions

1. What are the factors to be taken into account when storing fresh meats, poultry, and produce?(8pts)

Test I choose the best answer

2. Which of the following factors determine the Shelf-life of fluid milk products (2pts)?
   A. Heat treatment
   B. Additional processes
   C. Filling conditions
   D. Temperature control
   E. All

Note: **Satisfactory rating - 8 points** **Unsatisfactory - below 8 points**

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

Information Sheet 6- Making materials and equipment selection

6.1. Making materials and equipment selection

5.1.4. Materials used in slaughterhouses and meat processing plants

Materials used in slaughterhouses and meat processing plants depend on the construction and size of buildings. Furthermore, the choice of materials will depend on possibilities of supplies and these possibilities will depend on geographical conditions, cultural traditions and expenditures on materials.

As far as possible local construction materials should be used. These may be quarry stone or lava blocks, concrete, limestone or asphalt stabilized bricks. Nevertheless concrete is recommended for floors. Materials should be chosen to facilitate cleaning.

Wood will often be available and will be used for different kinds of equipment but it has a certain disadvantage as regards hygiene. When wood is used for cutting boards and chopping blocks or other working surfaces, deep splits appear which will be difficult to clean especially because wood swells when moistened. When possible a better hygienic standard may result if wood is replaced by plastic, but only if the maintenance standard of the plastic is satisfactory. Cutting boards and chopping blocks must be planned regularly or when needed. Cutting boards should be preferred.

Slaughter Plant Facilities

It is recommended that slaughtering plants are situated far from areas where objectionable odors or particles are generated, such as dumps or chemical plants; they should also have accessibility; therefore, they should be connected to streets or highways but separated from other plants or buildings. Drinking water supply must be in good quantity because washing is a continuous operation throughout the plant. Carcasses are washed after dressing, so any bacterial contamination in the water supply will be passed to the meat substrate. As water contains high amount of grease, blood, hair, tissue, and bone particles, water disposal must be carefully calculated.

5.1.5. Milk collection, transport and delivery equipment

- Milk transport tankers and cans should be designed and constructed such that they can be effectively cleaned and disinfected.
- Milk transport tankers and cans should be designed and constructed to ensure complete drainage.
- Milk transport tankers and cans should not be used to transport any harmful substance. If milk transport tanks and cans are used to transport foods other than milk, precautions such as the implementation of adequate cleaning protocols should be taken to prevent any subsequent milk contamination.
- Surfaces of milk transport tankers, cans and associated equipment intended to come into contact with milk should be easy to clean and disinfect, corrosion resistant and not capable of transferring substances to the milk in such quantities as to present a health risk to the consumer.
- Milk cans and transport tankers (including the milk discharge area, valves, etc.) should be cleaned and disinfected with sufficient frequency in order to minimize or prevent contamination of milk.
- After disinfection, tankers and cans should be drained.
- Lorries, trucks or other vehicles which carry the tank or cans should be cleaned whenever necessary.

Self-check 6	Written test

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

Test I Short Answer Questions

1. What are the factors to be taken into account when storing fresh meats, poultry, and produce?(8pts)

Test I choose the best answer

1. Which of the following factors determine the Shelf-life of fluid milk products (2pts)?
   B. Heat treatment
   C. Additional processes
   D. Filling conditions
   E. Temperature control
   F. All

Note: **Satisfactory rating - 8 points** **Unsatisfactory - below 8 points**

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

Information Sheet 7- Checking suitable PPE

2.1. Checking suitable PPE

The clothing of slaughterhouse workers must be clean. The purpose is not to protect the worker against contamination but to protect the meat/food against contamination. Working clothes must be used exclusively in the working area and nowhere else. If possible, it is advisable to avoid admittance from the unclean area to the clean area without changing clothes. Working routines should be planned in a way that the staff works either in the clean area or in the unclean area. The staff may eventually be allowed to go from clean to unclean work but never in the opposite direction, except when they have changed working clothes and washed hands.

Working clothes should be comfortable and easy to wash. Their design should encourage good hygiene habits. Light colored working clothes show the need for cleaning earlier than dark colored working clothes.

Working clothes should be free of loose adornments (buttons, sequins etc.). During work jewellery, wrist-watches etc. are prohibited as these objects may be sources for contamination and make hand-washing difficult.

Working clothes should ideally be supplied by the slaughterhouse and a laundry service is recommended to assure a certain level of hygiene. Arrangements for storage of aprons and tools should be available outside toilets and rest rooms.

The provision of hygienic equipment and personal protective equipment is essential to prevent contamination of meat and meat products through contact with clothes, shoes or direct contact with hands or breathe. Some appliances and protective clothes, boots etc. also serve to protect workers from accidents.

A. Hygienic equipment and materials:

Protective clothing – To avoid contamination of workplaces, materials and products from street clothes, workers have to wear clean protective clothing. Either one-piece overalls or two piece sets are recommended as they cover the complete body. In some workplaces only overcoats are used with the disadvantage that the trousers/skirt is not covered.

Head gear– Human hair on equipment, materials and products must be avoided. Caps and/or hairnets are used to cover and contain hair.

Gloves – In meat processing, staff are encouraged to wear latex gloves to avoid direct contact of materials and products with hands. This is of special importance during packaging, when also mouth protection is recommended to avoid contamination of fresh and processed products.

Gum (rubber) or **plastic boots**– These boots are used to protect staff in meat operations from moisture. The sole design facilitates a firm grip on slippery surfaces. For easy detection of dirt, boots are usually white.

Safety gloves – To avoid injuries to the hand handling the meat material during deboning and cutting, a safety glove is highly recommended for this hand. These gloves are made of a tight mesh of small stainless steel rings and should be chosen long enough to also cover the wrist. To avoid unnecessary meat and fat residues in the mesh, the glove can be covered with a latex glove.

Fig 7 Safety gloves

Plastic aprons– This type of apron is used to protect workers and their working clothes from moisture, meat and fat. Plastic aprons should be long enough to overlap the boots, thus allowing splash water to rinse off.

B. Appliances for safety reasons:

Safety aprons – Almost 50% of all injuries in meat operations are caused by knives. Most of these occur during deboning when the knife is moved towards the body. To avoid such injuries, special safety aprons should be used, covering the front of the body.

Safety aprons can consist of a tight mesh of stainless steel rings or overlapping aluminum chips. To avoid unnecessary meat and fat settlements in the mesh, the safety apron is worn under a plastic apron.

Fig 8 anti-cut glove and apron

Safety helmets – In workplaces where there is a risk of objects falling, staff are encouraged to wear safety helmets made of firm plastic.

Helmets are strongly recommended are slaughter lines, below overhead rails and in storerooms with high shelves.

Self-check 7	**Written test**

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

Test I Short Answer Questions

1. What is the importance of PPE? (4pts)
2. List the PPE used for handling? (4pts)

Note: **Satisfactory rating - 8 points** **Unsatisfactory - below 8 points**

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

LG #85	**LO #2- Determine animal product and by product handling systems**
Instruction sheet	
This learning guide is developed to provide you the necessary information regarding the following content coverage and topics: • Identifying and analyzing available animal products handling systems • Identifying components of the on-farm animal products and by products handling systems requirements • Performing slaughtering procedure and distributing processed meat to butchers and export	

- Receiving and storing by products
- Ensuring stock balance control
- Identifying and reporting OHS hazards and risks assessed

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

- Identify and analyze available animal products handling systems
- Identify components of the on-farm animal products and by products handling systems requirements
- Perform slaughtering procedure and distributing processed meat to butchers and export
- Receive and store by products
- Ensure stock balance control
- Identify and report OHS hazards and risks assessed

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, ask your trainer for further instructions or go back to “Operation sheets”.

Information sheet – 1 Identifying and analyzing available animal products handling systems

1.1. Identifying and analyzing available animal products handling systems

1.1.1. Meat handling

1.1.1.1. Principles of meat hygiene applying to establishments, facilities and equipment

- Establishments should be located, designed and constructed so that contamination of meat is minimized to the greatest extent practicable.
- Facilities and equipment should be designed, constructed and maintained so that contamination of meat is minimized to the greatest extent practicable.
- Establishments, facilities and equipment should be designed to allow personnel to carry out their activities in a hygienic manner.
- Facilities and equipment that are in direct contact with edible parts of animals and meat should be designed and constructed so that they can be effectively cleaned and monitored for their hygiene status.
- Suitable equipment should be available for control of temperature, humidity and other factors as appropriate to the particular processing system for meat.
- Water should be potable except where water of a different standard can be used without leading to contamination of meat.

1.1.1.2. Temperature control

In the absence of suitable temperature, humidity and other environmental controls, meat is particularly vulnerable to survival and growth of pathogens and spoilage micro-organisms.

Facilities and equipment should be adequate for:

- Cooling, chilling and/or freezing of meat according to written specifications;
- Storage of meat at temperatures that achieve the safety and suitability requirements; and
- Monitoring of temperature, humidity, air flow and other environmental factors so as to assure that process control regimes are achieved.

Where steam is generated in the cooking of meat, it should be properly vented out of the area in order to minimize the potential for condensation and not be allowed to permeate into adjoining rooms.

1.1.1.3. Facilities and equipment for personal hygiene

Facilities for personal hygiene should include:

- changing rooms, showers, flush toilets, hand-washing and hand-drying facilities in the appropriate locations, and separate areas for eating; and
- Protective clothing that can be effectively cleaned and minimizes accumulation of contaminants.
- All areas, in which exposed meat may be present, should be equipped with adequate facilities for washing hands that:
  - ✓ Are located convenient to work stations;
  - ✓ Have taps that are not operable by hand;
  - ✓ Supply water at an appropriate temperature, and are fitted with dispensers for liquid soap or other hand cleansing agents;
  - ✓ Include hand drying equipment where necessary, and receptacles for discarded paper towels; and
  - ✓ Have waste water ducted to drains.

1.1.1.4. Means of transport

Vehicles or shipping containers in which unprotected meat is transported should:

- Be designed and equipped so that the meat does not contact the floor;
- Have joint and door seals that prevent entry of all sources of contamination; and
- Where necessary, be equipped so that temperature control and humidity can be maintained and monitored.

1.1.1.5. Ante-mortem inspection

Animals described below should be subject to special controls, procedures or operations imposed by the competent authority (which may include denial of entry to the abattoir) when:

- Animals are not sufficiently clean;
- Animals have died in transit;

- A zoonotic disease posing an immediate threat to either animals or humans is present, or suspected;
- An animal health disease subject to quarantine restrictions is present, or suspected;
- Animal identification requirements are not met; or
- Declarations from the primary producer, if required by the competent authority (including compliance with good veterinary practice in the use of animal medicines), are absent or inadequate.

1.1.1.6. Hygiene requirements for slaughter and dressing

- Only live animals intended for slaughter should be brought into an abattoir, with the exception of animals that have undergone emergency slaughter outside the slaughterhouse and have appropriate veterinary documentation.
- No animal other than an animal intended for slaughter should enter an abattoir, with the exception of animals used for stock handling provided these animals stay in the live animal handling area of the abattoir.
- An animal should only be slaughtered or dressed in an abattoir if a competent person is available to undertake ante- and post-mortem inspection. In cases of emergency slaughter where a competent person is not available, special provisions established by the competent authority will apply to ensure that the meat is safe and suitable for human consumption.
- All animals brought to the slaughter floor should be slaughtered without delay, and stunning, sticking and bleeding of animals should not proceed at a rate faster than that at which bodies of animals can be accepted for dressing.

1.1.1.7. Post-mortem inspection

All carcasses and other relevant parts should be subjected to post-mortem inspection, which preferably should be part of an overarching, risk-based system for the production of meat.

Post-mortem inspection systems should include:

- Procedures and tests that are risk-based to the extent possible and practicable;

- Confirmation of proper stunning and bleeding;
- Availability of inspection as soon as is practicable after completion of dressing;
- Visual inspection of the carcass and other relevant parts, including inedible parts, as determined by the competent authority;
- Palpation and/or incision of the carcass and other relevant parts, including inedible parts, as determined by the competent authority according to a risk-based approach;
- Additional palpation and/or incisions, as necessary to reach a judgment for an individual carcass and other relevant parts, and under appropriate hygiene control;
- More detailed inspection of edible parts intended for human consumption compared with inspection of those parts for indicator purposes alone, as appropriate to the circumstances;
- Systematic, multiple incisions of lymph nodes where incision is necessary;
- Other organoleptic inspection procedures, e.g., smell, touch;
- Where necessary, laboratory diagnostic and other tests carried out by the competent authority or by the establishment operator under instruction;
- Performance objectives or performance criteria for the outcomes of organoleptic inspection, if available;
- Regulatory authority to slow or halt processing so as to allow adequate post-mortem inspection at all times;
- Removal of specified parts if required by the competent authority,
- Proper use and secure storage of equipment for health marking.

Meat passed as safe and suitable for human consumption should be:

- Removed without delay from the dressing area;
- Handled, stored and transported in a manner that will protect it from contamination and deterioration;
- Held under conditions that reduce its temperature and/or water activity as quickly as possible, unless cut up or de-boned pre-rigor; and
- Held at temperatures that achieve safety and suitability objectives.

In the case of poultry or farmed game birds undergoing immersion chilling:

- The immersion chilling process should meet hygiene criteria as specified by the competent authority;
- The reduction in carcass temperature should be as rapid as possible;
- Carcasses emerging from the process should have a lesser microbiological count for indicator organisms and pathogens than those entering the process; and
- Sanitation requirements should include complete emptying, cleaning and sanitation of tanks as appropriate.

Where meat is packaged or wrapped:

- Packaging material should be suitable for use, stored and used in a hygienic manner; and
- Cases or cartons should have a suitable inner liner or other means of protecting the meat, except that the liner or other protection may not be required if pieces of meat, such as cuts, are individually wrapped before packing.

Where meat is placed in a room for freezing:

- Meat that is not in cartons should be hung or placed on racks or trays in a manner that allows adequate circulation of air;
- Meat that is not in cartons should be held in a manner whereby the potential for cross-contamination via dripping of liquids is prevented;
- Cartons containing meat should be stacked so as to permit adequate circulation of air; and
- Meat held on trays should be placed so as to avoid contact with the base of an upper tray.

Where meat is held in a freezer room or storage facility:

- The temperature of the meat should have been reduced to an acceptable level before placement;
- Exposed meat must be stored in such a way that the hygiene cannot be compromised by the presence of packaged meat or packaging material;
- Meat, whether in carcass form or in cartons, should not be stacked directly on the floor and should be positioned so that there is adequate air circulation;

- The freezer store should be operated and maintained under conditions appropriate to maintaining the safety and suitability of meat;
- Temperatures should be continuously recorded and monitored; and
- Adequate inventory control should be maintained.

Parts of animals deemed unsafe or unsuitable for human consumption should be:

- Placed without delay into specifically identified chutes, containers, trolleys, or other handling facilities;
- Identified by means as appropriate to the type and end use of the tissue;
- In the case of condemned material, handled in rooms reserved for that purpose and conveyed in a secure manner to a place of disposal (e.g. rendering station).

1.1.2. Milk handling

Milking is the defining activity of dairy farming. Consumers demand high standards of milk quality, so milking management aims to minimize microbial, chemical and physical contamination.

Milking management covers all aspects of the process of obtaining milk from animals quickly and effectively, while assuring the health of the animals and the quality of the milk.

Consistency in the day-to-day implementation of milking procedures is an important part of good dairy farming practice for milking.

This Fact Sheet describes practices that ensure milk is harvested and stored under hygienic conditions, and that the equipment used to harvest and store milk is well maintained.

The suggested good dairy farming practices for milking hygiene are set out under the following headings:

- Ensure milking routines do not injure the animals or introduce contaminants into milk.
- Ensure milking is carried out under hygienic conditions.
- Ensure milk is handled properly after milking.

1.1.2.1. Ensure milk is cooled or delivered for processing within the specified time

Cool milk as soon as possible after milking to the required storage temperature and within the specified time. Cooling times and storage temperatures should conform to limits set by the relevant authority.

Limits on the time taken between milking and delivery to the milk collection centre may exist in developing countries where the cooling or processing of milk is undertaken off the farm.

1.1.2.2. Ensure milk storage area is clean and tidy

Milk should be stored away from the milking area. The milk storage area should:

- Be clean and clear of accumulated rubbish, any products or chemical substances not in constant use and any feedstuffs;
- Have hand washing and drying facilities; and
- Be easy to clean and have pest control practices in place.

1.1.2.3. Ensure milk storage equipment is adequate to hold milk at the specified temperature

The storage equipment should be capable of holding milk at the required temperature until collection, and be constructed of materials that do not taint the milk.

Bulk tanks should be built to recognized standards and milk refrigeration systems should have a regular maintenance and service program to prevent breakdowns. The bulk tank should be equipped with a thermometer to check the temperature of the milk and appropriate records kept of storage temperatures. Ensure that all of the equipment is working properly.

1.1.2.4. Ensure milk storage equipment is cleaned after each milk collection

To ensure milk storage equipment is clean before use, clean and, when necessary, sanitize it after each milk collection. Milk contact surfaces should be sanitized as required in accordance with national recommendations and regulations.

1.1.2.5. Ensure unobstructed access for bulk milk collection

Provide unobstructed access to the milk storage area to enable the safe collection of milk.

Access to the milk collection areas should be free of animal pathways, mud and other potential contaminants.

1.1.2.6. Ensure milk storage temperature and temperature controls

Best practice would be to ensure that the milk is stored and transported at no more than 7°C, even if it is to be rendered by midday the day after it was obtained.

Grade “A” milk is carefully produced, processed and packaged in order to protect the safety of the consumer. Grade A milk must be pasteurized to be sold by retailers in interstate commerce. Raw milk is usually pasteurized either by low temperature pasteurization in which the milk is heated to 145 °F or higher for at least 30 minutes, or by high temperature pasteurization in which the milk is heated to 161 °F or higher for at least 15 seconds and then quickly cooled. Pasteurization destroys disease-causing bacteria and extends the shelf life of milk. However, pasteurized milk can readily spoil and could cause foodborne illness if not properly protected and handled.

1.1.3. Egg handling systems

1.1.3.1. Proper Egg Cleaning and Handling

- Collect eggs in an easy to clean container like coated wire baskets or plastic egg flats. This will prevent stains from rusted metal and contamination from other materials which are difficult to clean and disinfect.
- Do not stack eggs too high. If collecting in baskets do not stack eggs more than 5 layers deep. If using plastic flats do not stack more than 6 flats. If you stack eggs too deep you will increase breakage.
- Never cool eggs rapidly before they are cleaned. The egg shell will contract and pull any dirt or bacteria on the surface deep into the pores when cooled. Try to keep the temperature relatively constant until they are washed.
- Wash eggs as soon as you collect them. This helps limit the opportunity of contamination and loss of interior quality.
- Wash eggs with water 10 degrees warmer than the egg. This will make the egg contents swell and push the dirt away from the pores of the egg. If you have extremely dirty eggs, a mild detergent approved for washing eggs can be used. Never let eggs sit in water. Once the temperature equalizes the egg can absorb contaminants out of the water.

- Cool and dry eggs quickly after washing. Store eggs, large end up, at 50-55°F and at 75% relative humidity. If eggs sit at room temperature (75°F) they can drop as much as one grade per day. If fertile eggs are kept at a temperature above 85°F for more than a few hours the germinal disc (embryo) can start to develop. If fertile eggs are kept above 85°F over two days the blood vessels of the embryo may become visible. If eggs are stored properly in their own carton or other stable environment they should hold a quality of Grade A for at least four weeks.

1.1.3.2. Sorting and grading eggs

It is best that you sort the eggs before you store, sell, or consume them. The easiest way to sort eggs is to candle them with a bright light. This process can help eliminate cracked eggs or eggs with foreign matter inside like blood spots.

I. Eggs Candling:

- Hold the egg up to the candling light in a slanting position
- See the air cell, the yolk, and the white. The air cell is almost always in the large end of the egg. Therefore, put the large end next to the candling light.
- Hold the egg between your thumb and first two fingers.
- Then by turning wrist quickly, can cause the inside of the egg to whirl. This will tell a great deal about the yolk and white.

When learning to candle, will find it helpful to break and observe any eggs in doubt about.

II. **Identifying cracks:** cracked eggs will appear to have a white line somewhere on the shell. These cracks will open if apply slight pressure to the shell. Remove cracked eggs and consume them as soon as possible or discard.

III. **USDA grade standard:** Use the specifications given in the table below to determine the grade of an egg by candling. Consider air cell depth, yolk outline, and albumen quality.

Self-check 1	Written test

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

Test I Short Answer Questions

1. What is the importance of Ante-mortem inspection and procedures? (3points)
2. Why candling is important? (3 points)

II. Test I choose the best answer

1. Which one the following is suggested good dairy farming practices for milking hygiene? (3 points)

A. Ensure milking routines do not injure the animals or introduce contaminants into milk.
B. Ensure milking is carried out under hygienic conditions.
C. Ensure milk is handled properly after milking.
D. All

Note: **Satisfactory rating - 9 points** **Unsatisfactory - below 9 points**

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

Information sheet 2 – Identifying components of the on-farm animal products and by products handling systems requirements

2.1. Identifying components of the on-farm animal products and by products handling systems requirements

2.1.1. Identifying components of the on-farm dairy animal products and by products handling systems

I. Ensure milking routines do not injure the animals or introduce contaminants into milk

A. Identify individual animals that require special milking management

Individual animals should be easily identifiable by all people who come in contact with them. The system used should be permanent, allowing individual animals to be identified from birth to death. Additional temporary identification systems should be in place on farms to manage animals that require special handling at milking, such as treated or diseased animals, or animals producing milk that is not suitable for human consumption.

B. Ensure appropriate udder preparation for milking

- Wash and dry dirty teats before milking.
- Only milk animals with clean, dry teats.
- Check the udder and teats for any abnormalities which may indicate clinical mastitis.
- The foremilk may be extracted and checked for abnormalities before each animal is milked.
- This may be a regulatory or contractual requirement for dairy animals in some countries.

C. Milk animals regularly using consistent milking techniques

Institute regular milking times and routines. Ensure good milking technique is consistently applied. Incorrect or variable milking techniques can result in a higher mastitis risk and injury to the animal.

The correct technique for machine milking is to:

- Prepare animals properly before milking;
- Attach the cups to clean, dry teats;
- Avoid unnecessary air ingress at cup attachment;
- Avoid over milking;
- Remove cups gently; and
- When necessary, apply teat disinfectant to each teat after milking according to national recommendations and regulations.

The correct technique for hand-milking is to:

- Restrain the animal to be milked using a method that does not cause pain or injury;
- Ensure the milker's hands are clean and dry;

- Prepare the teats for milking, ensuring they are clean and dry;
- Only use appropriate teat lubricants according to national recommendations and regulations;
- Handle the teats gently, ideally using the 'fist-grip' method, avoiding any discomfort,
- Pain or injury to the animal;
- Use buckets that are non-corrosive, easy to clean and disinfect, and do not taint the milk;
- Avoid contaminating the collected milk with foreign material such as dust, dirt, soil,
- Urine, manure (faeces) and protect it from flies; and
- When necessary, apply teat disinfectant to each teat after milking according to national recommendations and regulations.

D. Segregate milk harvested from sick or treated animals for appropriate disposal

Animals whose milk is unfit for human consumption should be milked last or with a separate bucket or system. Store or discard abnormal milk in a manner appropriate to the risk posed to people, animals and the environment.

E. Ensure milking equipment is correctly installed and maintained

Manufacturers' and local, regional or national recommendations should be followed for construction, installation, performance and maintenance of the equipment used for milking.

Inspect and replace perishable components if evidence of wear is found. Materials used for milking equipment that come into contact with milk and with cleaning and disinfecting fluids should be made from adequately resistant materials and should not impart a taint to milk.

Follow the manufacturers' instructions when using cleaning and disinfecting agents on milking equipment, including any requirements to rinse following application. Only use cleaning and disinfecting agents approved for use by the relevant authority. These chemicals should be used in a way that ensures they do not have an adverse effect on

the milk or milking equipment. Store all chemicals, other than those in routine use, in a lockable area away from the milk storage area.

F. Ensure a sufficient supply of clean water

A sufficient supply of clean water should be available for milking operations, for cleaning the equipment that comes into contact with milk and for cleaning the milking area.

The quality of the water should be suitable for its intended use. Standards regarding the quality of water used in milk production are mandated in many countries, including the use of potable water in cleaning surfaces that come into contact with milk.

II. Ensure milking is carried out under hygienic conditions

E. Ensure housing environment is clean at all times

A high standard of cleanliness should be maintained at all times in housing areas to decrease soiling of the udder and so protect udder health. The housing area should:

- Be designed to provide good drainage and ventilation and to avoid animal injury;
- Be of suitable size and designed to cater for the size of the animal and the herd;
- Have adequate loose bedding which is maintained in a hygienic condition.

All stalls and beds should be kept clean and dry (e.g. by replacing the bedding frequently).Regularly clean or scrape passageways to remove manure.

F. Ensure milking area is kept clean

The milking area should be designed to allow it to be kept clean and tidy. It should:

- Be easy to clean;
- Have a clean water supply;
- Have waste handling facilities; and
- Have sufficient temperature regulation, ventilation and light.

Construct holding yards to enable a high standard of cleanliness to be maintained.

G. Ensure the milker's follow basic hygiene rules

The milker should:

- Wear suitable and clean working clothes;
- Keep hands and arms clean especially when milking;
- Cover cuts or wounds; and

- Not have any infectious disease transmissible via milk.

H. Ensure milking equipment is cleaned after each milking

Establish a routine to ensure milking equipment is clean before each use. If mobile milking equipment is used, this may mean cleaning between each use.

Use chemicals approved for the cleaning and/or disinfecting of milking equipment. Use water of suitable quality heated to the required temperature. Milk contact surfaces should be disinfected as required and in accordance with national recommendations and regulations.

2.1.2. Identifying components of the on-farm meat products and by products handling systems

2.1.2.1. Design and construction of lairages

Lairages should be designed and constructed so that they do not lead to undue soiling of the animal, cause undue stress of the animal, or otherwise adversely impact on the safety and suitability of meat derived from animals held therein. Lairages should be designed and constructed so that:

- Animals can be held without overcrowding or injury, and are not exposed to climatic stress;
- There are appropriate layout and facilities for cleaning and/or drying of animals;
- Ante-mortem inspection is facilitated;
- Floors are paved or slatted and allow good drainage;
- There is an adequate supply and reticulation of clean water for drinking and cleaning, and facilities are provided for feeding where necessary;
- There is a physical separation between lairages and areas of an abattoir where edible material may be present;
- “Suspect” animals can be segregated and inspected in separate areas.

Special facilities may be required to handle condemned animals.

These facilities should be:

- Constructed so that all parts, gut contents and faeces from condemned animals can be held under secure containment as appropriate to the circumstances; and
- Constructed and equipped so as to facilitate effective cleaning and sanitation

Once the animals arrive at the abattoir, they should be left to rest in a holding pen since transport is a highly stressful experience, resulting in muscular congestion and glucose reserve depletion.

Effect	Comment
Stress	DFD and PSE meat
Bruises	It is the most important cause for production losses in the meat industry
Asphyxiation	Due to crowding in the trucks
Heart failure	In some pig breeds, and pigs not subjected to fasting
Heat stress	Due to high temperature and deficient ventilation
Stomach distention	Caused by tiding ruminant legs without turning the animal periodically
Dehydration	Due to log transport period, high temperature, and holding times without water supply
Fights	Mostly in cattle, when a pig transport stops nearby

Table 3 Effects of transport on animals and meat quality

2.1.1.1. Design and construction of slaughter areas

- Stunning and bleeding areas should be separated from dressing areas (either physically or by distance), so that cross-contamination of animals is minimized.
- Areas for scalding, dehairing, defeathering, scraping and singeing (or similar operations) should also be appropriately separated from dressing areas.
- Special facilities may be required to slaughter and dress “suspect” or injured animals.

Where these facilities exist they should be:

- Easily accessed from pens containing “suspect” or injured animals;
- Constructed with suitable facilities for hygienic storage of parts derived from “suspect” or injured animals; and

- Constructed and equipped so as to facilitate effective cleaning and sanitizing

2.1.3. Identifying components of the on-farm poultry products and by products handling systems

To insure egg quality in small flocks, egg producers must learn to properly handle the eggs they produce. This article will discuss how you can insure that your eggs will be of the highest quality and safe for consumption.

Layer house management

The condition of the egg that you collect is directly related to how well the flock is managed. Feeding a well-balanced ration, supplementing calcium with oyster shell, water, flock age and health all can affect egg quality. However, since these factors are covered in other publications, this fact sheet will place emphasis on egg quality and handling after it is laid.

i. Coop and Nest Management

- Keep the laying flock in a fenced area so they cannot hide their eggs or nest anywhere they choose. If hens are allowed to nest wherever they choose, you will not know how old eggs are or with what they have been in contact, if you can find them at all.
- Clean Environment: Keeping the layers environment clean and dry will help keep your eggs clean. A muddy outside run, dirty or damp litter and dirty nesting material will result in dirty, stained eggs. Clean-out the nest boxes and add deep clean litter at least every two weeks. Clean-out wet litter in coop and make sure the outside run area has good drainage and is not over grazed.
- Nest Space: Supply a minimum of four nesting boxes for flocks containing 15 hens or less.
- For larger flocks provide one (1) nest for every 4 to 5 hens in the flock. This will help limit egg breakage from normal traffic and daily egg laying.
- Make sure nests have a deep clean layer of litter to prevent breakage and help absorb waste or broken-egg material.

ii. Collect eggs early and often

Most flocks will lay a majority of their eggs by 10:00 am. It is best to collect the eggs as soon as possible after they are laid. The longer the egg is allowed to stay in the nest, the more likely the egg will get dirty, broken or will lose interior quality.

Collecting eggs at least twice daily is advisable, especially during extreme weather temperatures.

Other Considerations for Layer House Management:

- Rotate range areas often or allow enough area for birds in outside runs to prevent large dirt and mud areas from forming by over grazing.
- Prevent eggs from being broken in order to minimize a hen learning to eat an egg and developing egg eating habits.
- Free choice oyster shells will help strengthen the egg shells.
- Keep rats, predators and snakes away from the hen house. They often will eat eggs and contaminate the nesting boxes and other eggs.

Self-check3	**Written test**

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

Test I Short Answer Questions

1. Write procedures of appropriate udder preparation for milking? (3points)
2. Write the correct technique/procedures for machine milking? (3points)

Test II choose the best answer

1. What is the criterion of designing milking area to allow animal to be kept clean and tidy? (3points)
   A. Be easy to clean
   B. Have a clean water supply
   C. Have waste handling facilities
   D. Have sufficient temperature regulation, ventilation and light
   E. All

Note: **Satisfactory rating - 9 points** **Unsatisfactory - below 9 points**

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

Information sheet 3 – Performing slaughtering procedure and distributing processed meat to butchers and export

3.1. Performing slaughtering procedure and distributing processed meat to butchers and export

3.1.1. Performing slaughtering procedure

Slaughtering, the first step in the transformation of muscle into edible meat, affects the quality and quantity of meat. This depends on postmortem biochemical changes, related to sanitation, as well as physicochemical and physical attributes (aroma, color, and texture among others). From the quantity point of view, carcass yield is related to pre- and postmortem handling. However, carcass handling after leaving the slaughter floor also alters meat quality. A number of operations are included during transformation of muscle into meat, starting from slaughtering through refrigeration, wholesale storage, fabrication and distribution, and retail storage. Each one includes changes in physicochemical and microbial characteristics that finally affect quality. In any case, changes must be directed to improve quality and/or to extend shelf life.

I. Stunning

Stunning is the ability loss to experience physical experiences due to a mechanical, chemical, or electrical process that temporarily interrupts sensory perception. In animals, stunning is applied in order to establish an unconscious state and, in this way, to ensure it will not recover before drying by bleeding. At the same time, stunning ensures animal immobilization to avoid any damage to the operators during handling prior to the animal's death.

The stunning methods must fulfill several characteristics:

- Not affecting the meat shelf life, therefore the method must allow rapid bleeding avoiding contamination of internal tissues.
- Not affecting meat quality regarding its physical, chemical, and sanitary characteristics.
- To stun the animal preventing any unnecessary pain and suffering, but without causing its death.
- Easy to apply, requiring the minimum effort to the operator and avoiding difficulties in the use of stunning devices.
- Producing a rapid and efficient effect, adapting to the processing line and avoiding process repetitions.
- With no risks to the operator, either due to the direct application or to the animal's defensive movements.

Stunning methods can be divided into three groups, according to the principle the main device uses: electricity, contusion, and gas narcosis.

A. Electricity stunning

Electricity promotes unconsciousness due to an epileptic shock caused by massive neurotransmitters (glutamate and aspartate) discharge to the brain; when efficiently applied, it presents three phases: tonic, clonic, and recovery.

Electric shock stunning is usually applied to pigs and sheep, although in some cases is also used in cattle. The epileptic shock depends on the voltage intensity passing through the brain. If electricity goes through the brain, the animal is only stunned, and bleeding must be carried out within 30 s because the animal can recover consciousness. The electrodes must be placed on each side of the head and intensity must not be <250 mA and 75 V during 10 s; they are kept moist in a 20% saline solution to assure electricity conduction.

If bleeding is not carried out in a pig after 2–3 min of stunning, it will recover and in 5 min will be completely normal. If electricity goes through the heart, the shock is irreversible and kills the animal by electrocution. If electric shock is adequately applied, the animal will not feel any pain. Conversely, if amperage is not high enough, the animal may feel a painful shock.

If applied to cattle, electrical stunning must be applied in two stages; in a first stage a 2.5 amp discharge is applied in the head, and in a second the current is passed through the entire body.

The main advantage of electrical stunning is its high efficiency to cause unconsciousness when properly applied according to electric discharge, electrode placing, and time, among others. In addition, it is noiseless therefore the animal is usually not affected by equipment vibrations. However, electric stunning causes hemorrhages more frequently than other stunning methods

B. **Contusion Methods**

The principle underlying the use of this equipment is the trauma caused in the brain by a blow or by penetrating the skull, causing total or partial unconsciousness. They include captive-bolt and pneumatic pistols. Stunning with a captive bolt pistol consists in projecting a metallic cylinder into the animal's skull, this penetration is combined with a blow caused by the pistol against the animal's head; the cylinder is then returned to their original position for the next shot. However, in order to achieve an efficient stunning, the anatomical location where the pistol is placed must be carefully chosen.

Pneumatic pistols impact the animal's head without penetration, using compressed air at 160–180 psi; the blow permanently damages the brain cortex. Captive-bolt pistols are used in sheep and cattle; when this stunning method is used in pigs, the muzzle is applied just above the eye level, in the center of the forehead. The main problem in using pneumatic pistols is that if compressed air is too high it could harm the operator's hands, back, or arms. In addition, it is used only when the slaughtering rate is <240 or more animals per hour because recharge is time consuming.

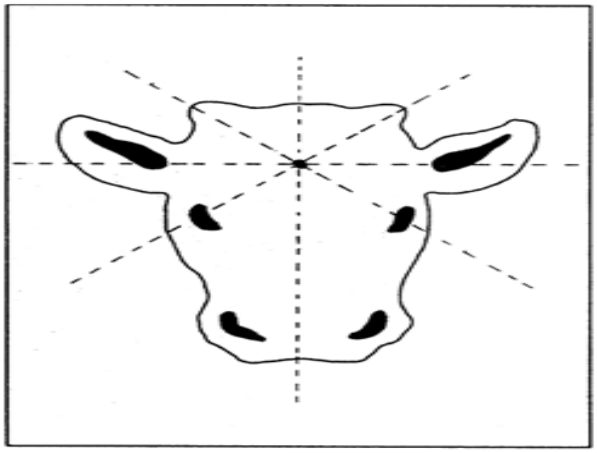

Fig 1 Captive-bolt stunner suitable for cattle

fig 2 stunning gun

C. **Carbon Dioxide**

It was developed specially for pigs although it is also applied to sheep; the stunning action of carbon dioxide (CO_2) is accomplished by blockade of the animal's neural terminals, reducing the nervous impulses. CO_2 concentrations of 65–70% during 45s work most efficiently. CO_2 stunning reduced hemorrhage incidence in the carcass and risks to the operators as animal's defensive movements are also. It is better for meat quality improvement.

The main disadvantage of this method is that facilities building and maintenance costs are very high.

Disadvantages of this method:

- Gas application must be carefully controlled; if the gas concentration is low, the animals are not adequately stunned.
- If it is too high, there is a tendency for stiffness, reflex muscular activity, and inadequate bleeding.
- If time of exposure is too long, skin congestion can occur and the carcass can take a bluish hue after scalding.

II. Bleeding

During unconsciousness, the animal dies by massive bleeding. There are a number of reasons to promote the animal's death during this period, the main one is for humane considerations. In addition, biochemical reactions proceed to obtain the optimum meat quality when the animal is properly stunned and slaughtered. When stunned, the animal is still alive; therefore, bleeding is achieved when the heart and respiratory functions are still working.

Bleeding is carried out by sectioning the carotid arteries and the jugular vein with a sticking knife (15–25cm long). The point of the knife is inserted about 2cm in front of the breastbone, an incision is made toward the jaw, penetrating 12–15cm and sectioning the carotid artery and jugular veins.

Care must be taken when introducing the knife to avoid puncturing the pleura, as this could cause the blood to flow into the chest cavity, increasing the risk of microbial contamination.

In sheep, the sticking knife is inserted immediately below and behind the ear, severing the jugular vein. In beef, an incision is made just in front of the sternum, also cutting into the main blood vessels, because blood is a vehicle for microbial distribution throughout the animal body, microorganisms introduced during sticking can be found after a few hours in other parts of the carcass.

Room temperature must be reduced to 10°C during slaughtering, bleeding, evisceration, and cleaning, as carcass temperature affects microbial growth. However, bleeding also reduces microbial contamination to a large extent. It also prevents the formation of “blood-splash” due to pressure built within the muscles, decreasing meat acceptability, and increasing hygienic risk.

III. Dressing, Evisceration, and Cleaning

After bleeding, the carcass undergoes cleaning operations by various methods, depending on the species. Cattle, sheep, horse, and goat hides are removed; viscera are also removed from the carcass of all species, and finally the carcass is trimmed and washed with pressurized water. The head, feet, and tail are left attached to the pig carcass, whereas head and hide are removed from beef carcasses.

Dehiding

Beef carcass dressing starts with dehiding making and incision on the neck centerline toward the head. The animal is then scalped, the horns chopped, and the head is skinned out. A cut is made across the larynx and the head is detached by cutting through the occipital joint. The front legs are cut, leaving the knucklebones on the carcass and the hind legs are cut through the tendons; the hide is then removed using a small saw. Legs in sheep carcasses are cut from the knuckle down the front legs; the skin is removed, starting from the neck up to the root of the tail; and the hind legs are cut.

Evisceration and Trimming

The most frequently used edible by-products are blood, liver, heart, kidney, tongue, heart, stomach, and lungs. The specific by-product, organ or tissue, considered edible by a given human population group depends on facts such as tradition, religion, and culture.

Inedible viscera and by-products are also utilized in other industries such as animal feeds, fertilizers, or pharmacy:

- Gall bladder, bones, and hooves from beef, sheep, and pigs;
- Horns and feet from sheep and beef;
- Wool and skin from sheep.
- Beef hide and hair from pigs
- Scraps and condemned parts can also be used for meat meals.

Pharmaceutical products are obtained from slaughter by-products:

- Thymus and thyroid of beef, sheep, and pig;
- Pig stomach lining; sheep prostate and intestine;
- Beef and sheep pancreas and suprarenal glands;
- Pig and beef ovaries and spleen;
- Beef pituitary and pineal glands, corpus luteum, parathyroid.

To remove the viscera, the abdominal cavity is opened by cutting behind the brisket; the liver is removed by cutting it from the diaphragm, which in turn is cut. The content of the chest cavity is removed and the aorta is trimmed. The body is then sawn, dividing the carcass into two sides. To prevent microbial contamination it is important to trim excessive tissue, the area where the sticking knife was introduced if this was the case, and the spinal cord. The carcass is then washed by high-pressure spraying (19 kg/cm2). Inclusion of head, hide, and feet in beef and sheep carcass weight depends on commercial agreements in each country or region.

3.1.2. distributing processed meat to butchers and export

Meat and poultry products must be refrigerated or frozen after processing and before shipment to inhibit spoilage and growth of pathogens. During transportation and storage, the challenge is to maintain proper refrigeration temperatures.

Most food is transported by truck. However, meat, poultry, and egg products may be transferred to and from other modes of transportation during shipment and held at intermediate warehouses as well as at transfer or handling facilities, such as airports, break-bulk terminals, and rail sidings. Because transportation and storage are vital

links in the farm-to-table food chain, effective control measures are essential at each point in the food distribution chain to prevent unintentional contamination.

Meat should be transported in a correct manner, to make sure no contamination takes place nor bacteria can grow on the product. There are three types of meat products produced as a result of slaughter:

- Fresh meat products
- Processed meat products
- Frozen meat products

Fresh meat products are transported with trucks from the slaughterhouse to the retailers and the super market. If a product is processed, the meat is transported from the slaughterhouse to the meat processing manufacturer and then to retailers and supermarkets.

To guarantee a healthy fresh product, the time of transportation from producer to consumer must be as short as possible. Not only time is important to guarantee a fresh product.

The following actions are further taken to ensure food safety during the transportation of fresh meat products:

- Before transportation poultry meat should be and kept at temperatures below 4˚C or 40˚F.
- The meat and meat products should be packaged and checked for leakers, temperature, packaging etc. before transportation.
- Meat is put in packages, boxes or crates when transported.
- Human contact should be limited with the products.

When transporting the meat once it has been taken home from the grocery store, depending on the travel time make sure the product is frozen. This will ensure its freshness for longer and will keep the product from reaching a degree above 40˚ F. Wrap the product in newspaper as an insulator, place the meat in a cooler, wrap the cooler in blanket covering all cracks to keep the product as cold as possible and preventing spoilage and bacterial growth.

Self-check 3	Written test

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

Test I Short Answer Questions

1. What are the characteristics of stunning methods must fulfill? (4 points)
2. What are main disadvantages and disadvantages of Carbon Dioxide method? (4pts.)

Note: **Satisfactory rating - 8 points** **Unsatisfactory - below 8 points**

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

Information sheet 4 - Receiving and storing by products

4.1. Receiving and storing by products

Owing to its composition making them a suitable substrate for pathogens and spoilage microorganisms, carcasses and viscera should be stored under refrigeration conditions. Refrigeration is any process that removes heat from a material.

Once the carcass is clean, refrigeration is necessary to 8°C or below to delay the multiplication of psychrophilic organisms associated to spoilage or any microorganisms of public health significance. Refrigeration also restricts enzymatic activity, although if ripening (or aging) is desirable as in the case of added-value beef, storage at higher temperature (12–15°C) during the initial post slaughtering period is necessary with further reduction to 4–6°C. Therefore, the optimum cooling temperature and time vary with the species and desired product,

In commercial slaughtering facilities, the types of installed refrigerators are bulk storage rooms. In these, the air movement around the unwrapped carcasses should be the minimum required to maintain a constant temperature so as to minimize weight loss and appearance changes associated with desiccation. Air distribution must be as homogenous as possible.

In few cases, controlled atmosphere storage rooms ensure optimal quality due to the considerable reduction of aerobic microorganisms; these types of storage rooms must include gas-tight seals to keep atmospheres with low oxygen and high nitrogen and CO_2 concentrations, making these facilities expensive. Additional installations are necessary to control gas concentrations.

Storage

- Storage of inedible animal parts such as hides, horns, hooves, feathers and inedible fats;
- Adequate natural or artificial lighting for hygienic process control;
- Appropriate facilities for the preparation and storage of edible fats;
- Access and harbouring of pests are effectively restricted; and

- Adequate facilities are provided for secure storage of chemicals, (e.g., cleaning materials, lubricants, branding inks) and other hazardous substances so as to prevent accidental contamination of meat.
- The average temperature of a cooler must be between 2°C and 6°C. A certain degree of “sweating” occurs when relative humidity is 70% or more.
- Required building material in coolers must be easy to clean; floors must have a slope to allow proper drain.
- Rails should be
    - ✓ At least 3.3 m above the floor for halves of beef,
    - ✓ 9 m for calves and hogs, and 2.25 m for quarters of beef;
    - ✓ Goat and sheep carcasses should be suspended 1.95 m to the hook.
- Carcasses must be hung 1m from the walls and 0.60m from the refrigeration equipment, with a separation among carcasses of 0.30m.
- Edible organs and offal should be placed in a separate cooler of the carcasses. Retained carcasses or parts should be located in a refrigerated separate compartment.

Self-check 4	Written test

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

Test I Short Answer Questions

1. How to store animal product and by product? (3points)
2. What is the deference between routes of drug administration? (3points)
3. What is the effect temperature control on the shelf life of products? (3 points)

Note: **Satisfactory rating - 9 points** **Unsatisfactory - below 9 points**

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

Information sheet 5 - Ensuring stock balance control

2.1. Ensuring stock balance control

The purpose of stock control is ensuring an appropriate balance. If have excess stock, then the organization's assets will be tied up in products that may become outdated and need to be stored or maintained. If the stock levels are insufficient, then will find it difficult to keep up with demand and generate revenue. This could also lead to higher shipping costs, as will constantly have to restock. Stock control systems should monitor how much of a particular item is remaining and prompt new stock orders when needed. This could either be done automatically by software or carried out manually by employees in accordance with procedures.

Expenditure or cost ideally, all items that you need to buy will match items identified in your budget. However, you will often need to buy other items that you haven't planned. You should prepare expenditure/cost systems to account for this.

This may include:

- Cash set aside in budgets for certain areas that can be drawn against later
- Adjusting budgets as get more information on the requirements
- Reporting what items have bought
- Setting up approval systems for employees who wish to order items
- Using tracking codes to record what has been bought

Shrinkage and wastage

Shrinkage occurs when organisations have fewer inventories than their records show. This could be due to recording errors, damage or theft. The shrinkage is the difference between the expected amount and the actual amount.

Wastage is a similar process in which less than 100% of the raw materials available are used to make the product; some may be damaged, spilt, or lost. For example, when making a cake, some of the ingredients are bound to miss the bowl. Wastage may be either normal (an expected part of the process) or abnormal (unexpected due to some new factor.)

Risks to health and safety as mentioned in

Systems for the control of risks may include:

- Assessing any new risk that enters the workplace
- Taking measures to reduce risks where possible (e.g. PPE, equipment)
- Training employees to work with risks properly
- Removing risks from the workplace Minimising employee exposure to risk

Carry safety stock to reduce risk of stock outs

Safety stock, also called buffer stock, is the layer of inventory kept to prevent stock outs and back orders in situations where the forecast is exceeded or supply is delayed. Safety stock minimizes disruptions caused by demand, supply chain or fulfillment disruptions, while investing the lowest possible amount of capital in inventory.

Many businesses (WMS and ERP systems) still use a basic stock days model to calculate safety stock e.g. they work out the number of days (or weeks) of demand and add enough buffer stock to cover any variance – for example, 4 weeks of cycle stock and 2 weeks of safety stock.

But this “one size fits all” approach assumes that all goods in the warehouse have similar demand patterns and behave the same. As we’ve already discussed, this is most certainly not the case. The more accurate you can make safety stock calculations, the less likely you are to experience out-of-stocks or overstocking situations. When calculating safety stock, the most important factors to consider are:

- The desired service level
- Forecasting accuracy
- Lead time (or delivery variation)

Self-check 5	Written test

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

Test I Short Answer Questions

1. What are Systems for the control of risks? (3points)

Test II choose the best answer

1. Which one is the most important factor when calculating safety stock? (3 points)
   A. The desired service level
   B. Forecasting accuracy
   C. Lead time
   D. All

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

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

Information sheet – 6 Recognizing all potential and existing OHS hazards

6.1. Recognizing all potential and existing OHS hazards

Occupational health and safety (OHS): actions to be taken to ensure safe operation and maintenance of machinery and equipment. In every activity of livestock rearing process must;

- Follow appropriate (safe) work procedure
- Use PPE when every necessary
- Identify and control hazards that occur when we work with livestock feed
- Use appropriate machine (equipment) and understand how to use

Safety and Health Considerations

When performing veterinary procedures, the clinician must recognize the potential for zoonosis. An assessment of the herd's health status through histories and physical examinations guards clinicians, technicians, and farm personnel and families against zoonotic infections. Stress and trauma to the livestock are to be avoided. Producers who are able to have frequent, nonthreatening interactions with their goats will reduce the herd's apprehension of being handled.

Contaminated raw materials present a more serious problem:

- It is difficult to determine whether or not a shipment is contaminated.
- Testing is costly, and the means are not always available.

The possible strategies to deal with this problem are:

- Avoiding the use of risky raw materials (poor quality peanuts and oil meal). This solution is not very realistic in the context of a generalized lack of raw materials for animal feed.
- Chemical detoxification of the risky raw materials. This treatment is expensive and difficult (pressurized ammonia), but it is effective. It can only be used by large industries that wish to be able to export oil meal that meets the standards of Western countries.

- Attempting to efficiently manage the supply of raw materials according to knowledge of contamination risk factors. This solution is difficult to implement in developing countries (poorly structured supply chains, small-scale producers). Furthermore, “risky” raw materials will always be used in some way, which does not resolve the public health problem.
- Using additives that supposedly absorb aflatoxins and thus prevent their absorption by the animal. Such additives (specific types of clay, activated carbon) exist on the Countries with hot climates are more exposed to microbial and fungal contamination. Furthermore, there are often residues (pesticides, etc.) in raw vegetable matter. For countries with less structured supply chains, it is also difficult to prevent contamination via inappropriate additives.

Furthermore, in developing countries, it is difficult to undertake the monitoring and testing necessary to protect the population: these measures are often difficult and costly to implement for small-scale farmers.

6.1.2. Assessing and controlling risk

Potential hazards like animal movement and handling, exposure to hazardous noise, dust and solar radiation and veterinarian chemicals, and zoonotic diseases in the workplace are recognized, risk assessed and controlled by using suitable personal protective equipment , by disposing appropriately residues like fly blown fleece, maggots and chemical residues and Properly move animals including giving animal time to settle post-treatment, conducting the move in a controlled and quiet manner to correct paddock or sickbay according to OHS requirements.

Self-check 2	Written test

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

Test I Short Answer Questions

1. What are the OHS must ensure safe operation and maintenance of machinery and equipment in every activity of handling process? (5 points)

2. What are the common relevant hazards? (4 points)

Note: **Satisfactory rating - 9 points** **Unsatisfactory – below 9 points**

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

Operation Sheet 1	Post-mortem inspection

Objectives

- To perform Post-mortem inspection
- To identify any meat quality defects

Equipment

- Glove
- Masks
- Apron
- Rubber boots

Procedure

1. use personal protective clothes
2. Visual inspection of the carcass and other relevant parts, including inedible parts, as determined by the competent authority;
3. Palpation and/or incision of the carcass and other relevant parts, including inedible parts, as determined by the competent authority according to a risk-based approach;
4. Additional palpation and/or incisions, as necessary to reach a judgment for an individual carcass and other relevant parts, and under appropriate hygiene control;
5. More detailed inspection of edible parts intended for human consumption compared with inspection of those parts for indicator purposes alone, as appropriate to the circumstances;
6. Systematic, multiple incisions of lymph nodes where incision is necessary;
7. Other organoleptic inspection procedures, e.g., smell, touch;
8. Where necessary, laboratory diagnostic and other tests carried out by the competent authority or by the establishment operator under instruction;
9. Performance objectives or performance criteria for the outcomes of organoleptic inspection, if available;
10. Regulatory authority to slow or halt processing so as to allow adequate post-mortem inspection at all times;
11. Removal of specified parts if required by the competent authority,
12. Proper use and secure storage of equipment for health marking.

Operation Sheet 1	Eggs Candling

Objectives

- To undertake candling
- To identify egg quality

Equipment

- Candler
- Egg
- Power source

Procedure

1. Hold the egg up to the candling light in a slanting position
2. See the air cell, the yolk, and the white. The air cell is almost always in the large end of the egg. Therefore, put the large end next to the candling light.
3. Hold the egg between your thumb and first two fingers.
4. Then by turning wrist quickly, can cause the inside of the egg to whirl. This will tell a great deal about the yolk and white.

LAP TEST	Performance Test

Name…… ID…… Date……

Time started: _____ Time finished: _____

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

Task 1

Performing candling

Identifying egg quality

Task 2

Performing post-mortem inspection

Identifying any meat quality defects

LG #45	LO #3- Install and operate animal products and by products handling equipment

Instruction sheet

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

- Installing plate cooler and other components of the pre-cooling system
- Installing refrigeration system
- Completing commissioning tests
- Completing routine maintenance program requirements
- Storing and restocking animal by-product and cleaning work area

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

- Install plate cooler and other components of the pre-cooling system
- Install refrigeration system
- Complete commissioning tests
- Complete routine maintenance program requirements
- Store and restock animal by-product and cleaning work area

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, ask your trainer for further instructions or go back to “Operation sheets”.

Information sheet 1 - Installing plate cooler and other components of the pre-cooling system

3.1. Installing plate cooler and other components of the pre-cooling system

Compressor Mounts:

Hermetic Compressors – hermetic compressor springs are mounted internally; check the compressor mounting bolts to ensure the nuts have not become loose during shipment.

Semi-Hermetic Compressors – most semi-hermetic compressors have external spring mounts and are factory assembled. The following actions are required once the condensing unit is installed and before system start-up:

- Loosen the upper mounting nuts.
- Remove the spring steel clips from the mounting springs.
- Retighten the upper mounting nuts until the compressor can float on the springs approximately 1/16” between the mounting nut and rubber grommet.

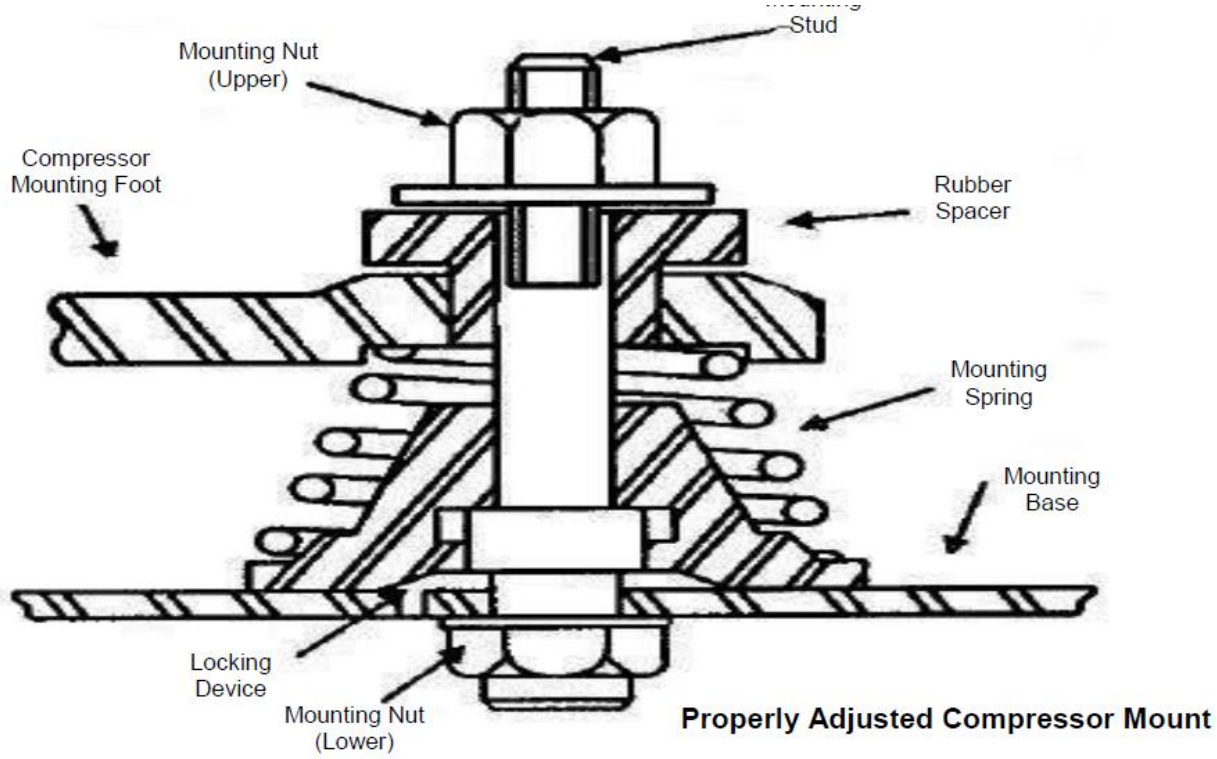

Diagram 1 Properly Adjusted Compressor Mount

After all system checks have been checked, properly adjusted, and verified, replace all Schrader caps, service valve caps, electrical box covers, housings, etc.

Compressor Superheat:

Compressor superheat is a critical value that must be checked. Check the compressor superheat as follows:

- Determine the suction pressure at the suction service valve of the compressor.
- Determine the saturation temperature at the observed suction pressure using refrigeration pressure temperature tables.
- Measure the suction line temperature 6 -10 inches away from the compressor.
- Subtract the saturation temperature (step 2) from the measured temperature (step 3). The difference is the superheat of suction gas.

A low suction superheat can cause liquid to return to the compressor. This will cause dilution of the oil and eventual failure of the bearings, rings and valves. A high suction superheat will cause excessive discharge temperatures, which cause a breakdown of the oil. This causes piston ring wear, and piston and cylinder wall damage. System capacity decreases as the suction superheat increases. For maximum system capacity, keep the suction superheat as low as practical. Copeland requires a minimum compressor superheat of 20°F; however, to improve compressor life, 25°F to 40°F is preferred. Adjust the expansion valve at the evaporator when adjustments to the suction superheat are necessary. Refer to “Evaporator Superheat” on the next page for more information.

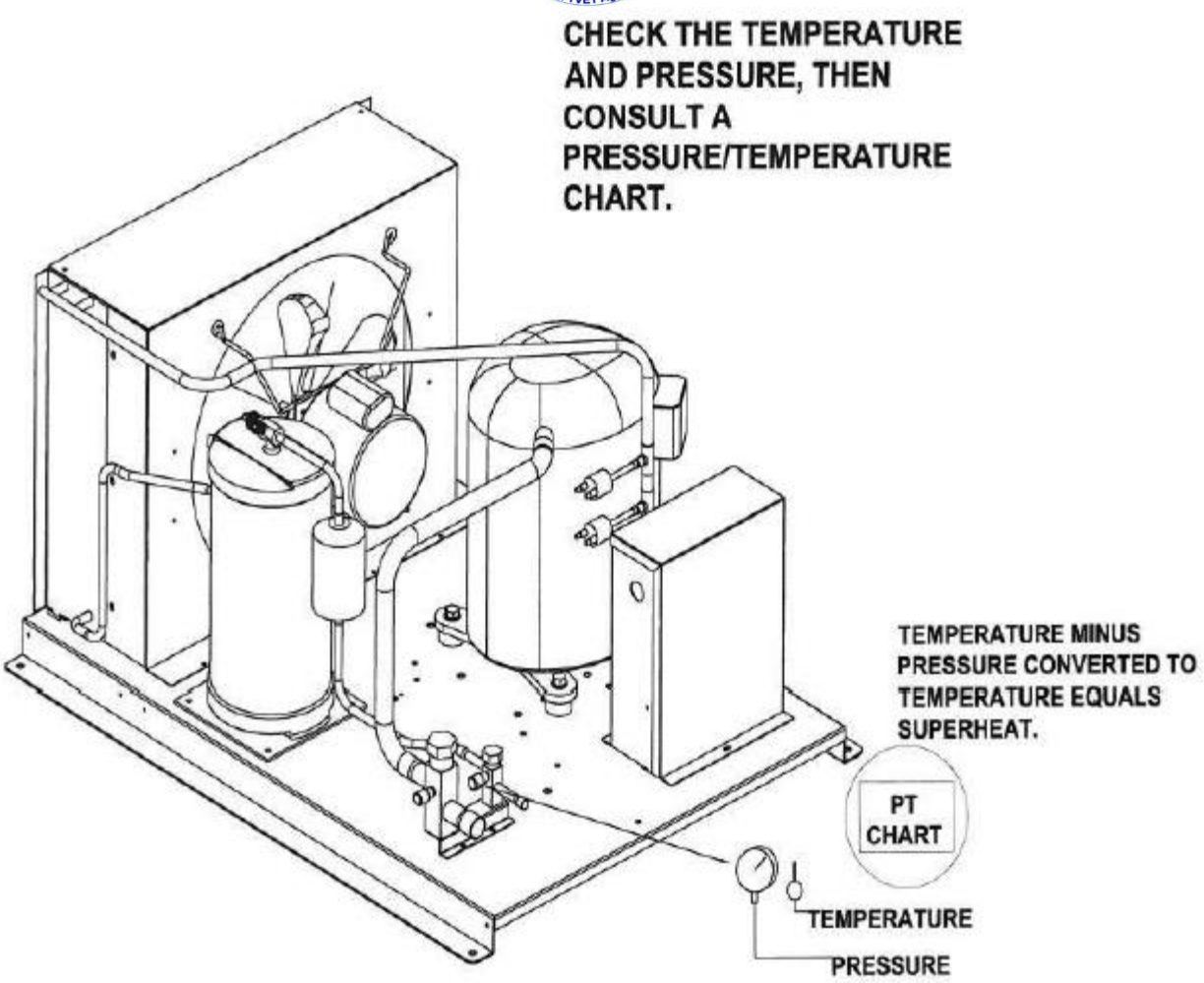

Diagram 2 Determine compressor superheat

Evaporator Superheat:

Check the evaporator superheat once the walk-in has reached the desired temperature. Generally, systems with a design temperature drop of 10°F should have an evaporator superheat value of 6° - 10°F on freezers and 8° - 12°F on coolers for maximum efficiency.

To determine the evaporator superheat:

- Measure the suction pressure at the evaporator outlet.
- Convert the pressure to saturation temperature referencing a temperature-pressure chart.
- Measure the temperature of the suction line at the expansion valve bulb. Ensure the bulb is mounted at the correct location on the suction tube.

- Subtract the saturation temperature reading (step 2) from the measured temperature (step 3). The difference is the evaporator superheat.

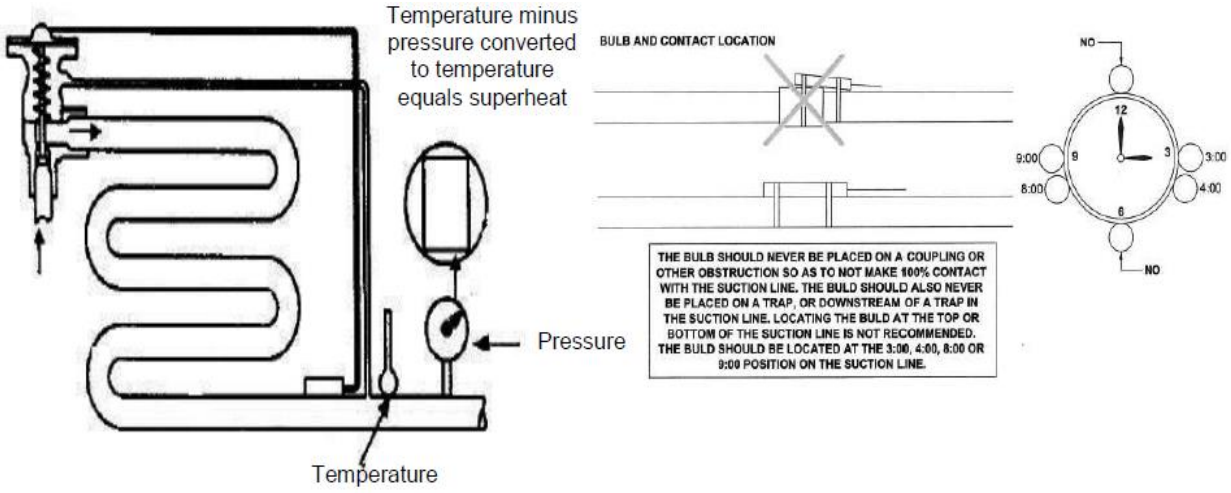

Diagram 3 Determine evaporator superheat

Electric Defrost Timer

Instructions for setting the timer is located on the inside cover of the time clock. The defrost timer clock must be set to the correct time at initial start-up and after any power interruptions. Set the clock by rotating the clock face until the correct time is at the arrow on the face of the timer. The switch is programmed by pushing the captive trippers to the inner ring for the entire period the load is to be turned “ON”. When a tripper is pushed to the outside, the switch is in the “DEFROST” position. Each defrost tripper represents 15 minutes of defrost time. The timer is factory set for four defrost cycles daily at the following times: 4:00AM, 10:00AM, 4:00PM, and 10:00PM. Each defrost cycle is programmed for 45 minutes duration. The defrost times may be changed to initiate at periods of low activity (trippers pushed out will close contacts to terminals 1 & 3).

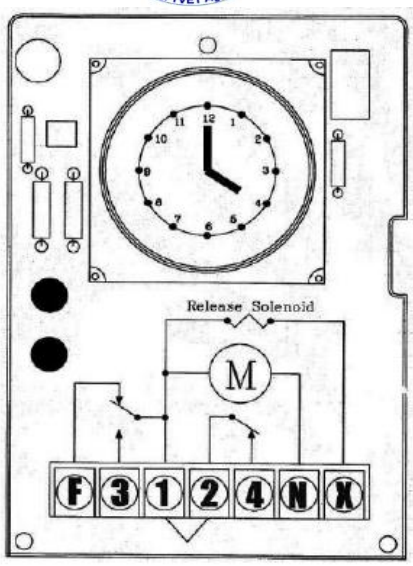

Diagram 4 Defrost Time Clock

When the defrost cycle begins:

- Switch 2 to 4 opens in the time clock, breaking the circuit to the room thermostat, liquid line solenoid, and evaporator fan motors. This allows the compressor to pump down and shut off. Simultaneously, switch 1 to 3 closes in the timer, energizing the defrost heaters.
- The heaters increase the coil temperatures above 32°F, melting the frost off the coil.
- When the coil warms to approximately 55°F, the defrost termination thermostat closes and energizes the switching solenoid in the timer. At this time, switch 1 to 3 in the timer opens, terminating the defrost heaters. Simultaneously, switch 2 to 4 closes in the time clock, energizing the temperature control circuit.
- Suction pressure rises, the low pressure control closes, and the compressor starts.
- The fan relay closes when the coil temperature reaches approximately 30°F. This energizes the fan motors.
- The system operates in the refrigeration cycle until another defrost cycle is initiated by the timer.

Air Defrost:

Instructions for setting the timer is located on the inside cover of the time clock. The defrost timer clock must be set to the correct time at initial start-up and after any power interruptions. Set the clock by rotating the clock face until the correct time is at the arrow on the face of the timer. The switch is programmed by pushing the captive trippers to the outer ring for the entire period the load is to be turned “ON”. When the tripper is pushed to the inside, the switch is in the “Defrost” position. Each defrost tripper represents 15 minutes of defrost time. The timer is factory set for four defrost cycles daily at the following times: 4:00AM, 10:00AM, 4:00PM, and 10:00PM. Each defrost cycle is programmed for 30 minutes duration. The defrost times may be changed to initiate at periods of low activity (trippers pushed out will close contacts to terminals 3 & 4).

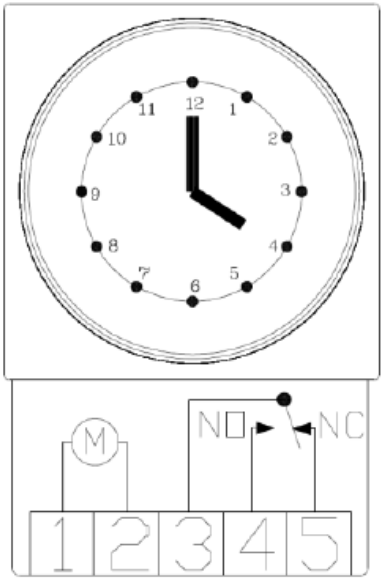

Diagram 5 Air Defrost timers

When the defrost cycle begins:

- Switch 3 to 4 opens in the time clock, breaking the circuit to the temperature control and liquid line solenoid valve. This allows the compressor to pump down and shut off. Note, the evaporator fans continue to run during the defrost cycle.
- At the end of the defrost duration, switch contacts 3 and 4 close, energizing the temperature control, solenoid valve circuit.

- The suction pressure rises. When the cut-in pressure setting of the low pressure control is reached, the compressor contactor is energized, and the compressor starts.
- The system operates in the refrigeration cycle until the next defrost cycle is initiated by the timer.

Self-check 1	Written test

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

Test I Short Answer Questions

1. **Write each parts compressor**? (12 points)
2. How to determine the evaporator superheat? (4 points)

Note: **Satisfactory rating - 16 points** **Unsatisfactory - below 16 points**

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

Information sheet 2 - Installing refrigeration system

2.1. Installing refrigeration system

Locating and Mounting Condensing Unit

General Guidelines:

- Check the selected installation location to ensure that racks, braces, flooring, foundations, etc. are adequate to support the condensing unit weight.
- The installation location is clean, dry, and level.
- Locate away from corrosive and noise sensitive atmospheres.
- Use the condensing unit skid and base when moving the unit. Do not remove unit from skid until the unit is moved to the mounting location.
- Mount the condensing unit base to pads or structural rails using properly sized bolts through the unit base.

Clearance Requirements:

- Locate where there is a sufficient and unrestricted supply of clean ambient air.
- Locate where this is adequate space for the removal of the heated discharged air from the condensing unit area.
- Do not position multiple units so that discharge air from one unit is blowing into the condenser inlet air of the other unit.
- All sides of the unit should be positioned a minimum distance equal to the total width of the condensing unit away from any other unit, wall, or obstruction.

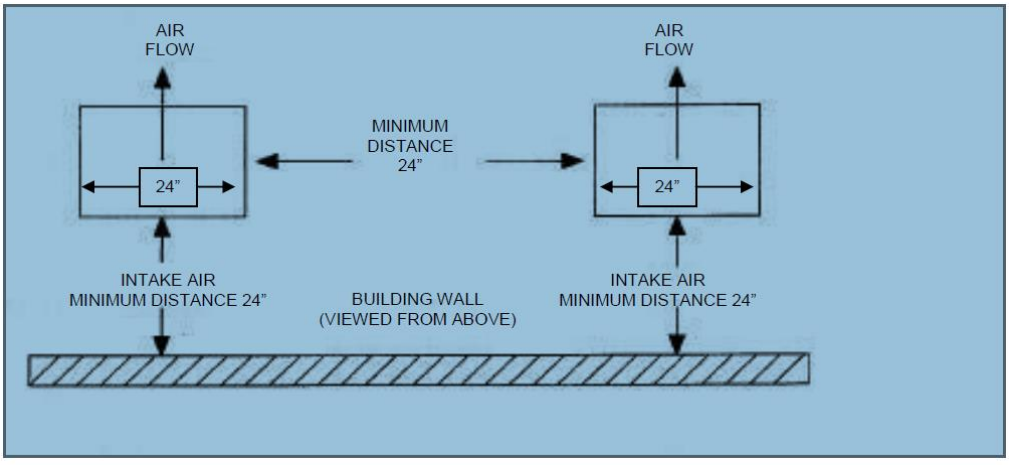

Diagram 6 Examples of Multiple Units with Horizontal Airflow

Locating and Mounting Evaporator Coil

General Guidelines:

- Do not place the evaporator above or close to door openings. This will help prevent potential icing problems.
- Allow a minimum clearance equal to or greater than the coil height on all sides of the coil for proper air flow and service access.
- Use the evaporator coil for a template to locate and drill the mounting holes (1/2" diameter).
- Place a 1" and a 1-5/8" washer on each nylon bolt and insert through the drilled mounting holes.
- Lift the evaporator coil until the nylon bolts extend through the mounting brackets.
- Install washers and secure with nuts. Tighten until the coil is firm against the ceiling. The evaporator coil must be level.
- Additional information is available in the installation manual supplied with the evaporator.

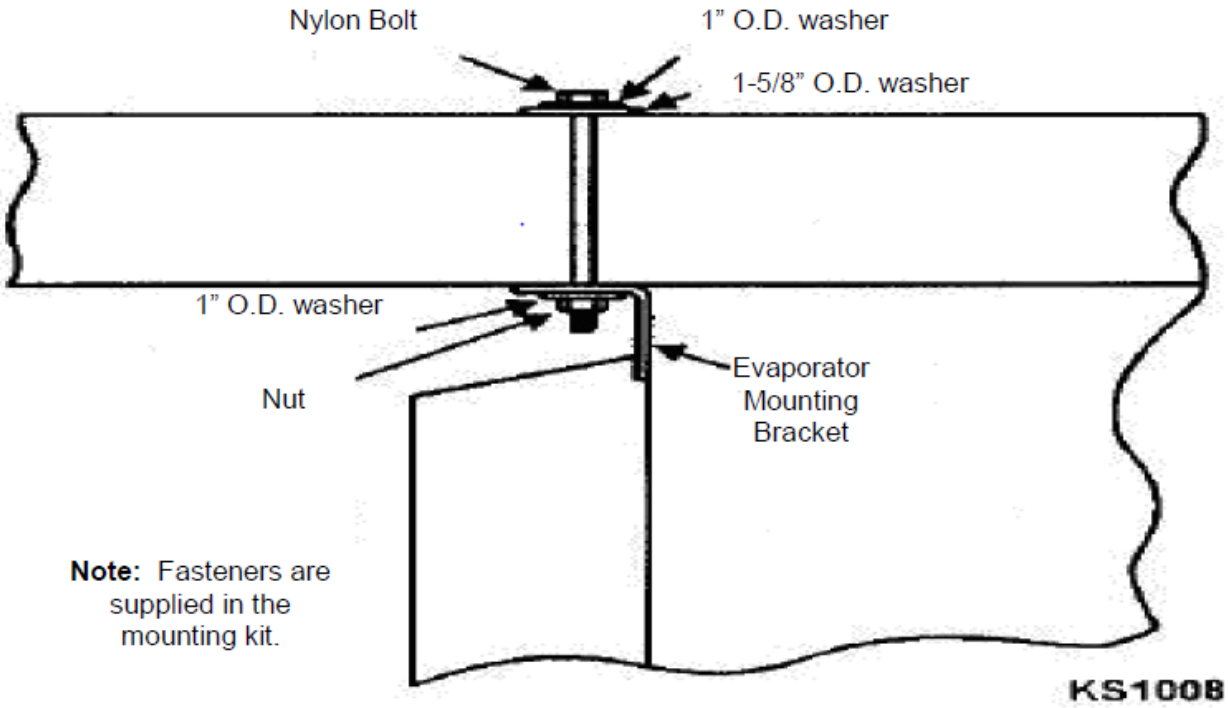

Diagram 7 Evaporator Coil Mounting

Wiring

All electrical connections and routing must comply with local and national codes. Do not modify the factory installed wiring without written factory approval. The field wiring must enter through the knockouts provided. Refer to the nameplate on the condensing or evaporator coil to determine the proper electrical power supply. Wire type should be of copper conductor only and properly sized to handle the electrical load. The unit and coil must be properly grounded. Condensing unit wiring diagrams are attached inside the electrical box cover. Evaporator coil wiring diagrams are located inside the installation folder. Copies of the wiring diagrams are also available in the back of this manual.

Piping

General Requirements:

All refrigeration piping and components are to be installed in accordance with applicable local and national codes and in conformance with industry refrigeration guidelines to ensure proper operation of the refrigeration system. Only refrigeration grade copper tubing should be used. Long radius elbows should be used. Short radius elbows have points of excessive stress concentration and are subject to breaking at these points, do not use short radius elbows. Suction lines must be insulated with a minimum ¾" thick arm flex to reduce heat pick-up.

Cleanliness:

Condensing units and evaporator coils are cleaned and dehydrated at the factory. The condensing unit must remain closed and pressurized until the piping is complete and final connections are ready to be made.

Do not remove system tubing covers until work is ready to be performed. Ensure that all refrigeration tubing is clean and dry prior to installation. Use only tubes cutters when trimming tubing to the proper length. Do not use saws to cut tubing.

Brazing joints require a dry inert gas, typically nitrogen, be passed through the lines at a low pressure to prevent scaling and oxidation. Use only silver solder brazing alloys.

Minimize the amount of flux to prevent internal contamination. Flux only the male portion of the joint. Thoroughly clean fluxed joints after brazing.

Pipe Supports:

All tubing should be supported in a least two locations (near the end of each tubing run). Long runs will require additional support. As a guide, support 3/8” to 7/8” pipe every five feet, 1-1/8” to 1-3/8” every seven feet, and 1-5/8” to 2-1/8” every ten feet. Do not leave a corner unsupported when changing directions. Place supports within 2 feet of each direction change. Piping that is attached to a vibrating object (such as a compressor or compressor base) must be supported in a manner that will not restrict the movement of the vibrating object. Rigid mounting will fatigue the tubing causing refrigerant leaks.

Oil Traps:

To ensure proper oil return to the compressor, a P-type oil trap should be installed at the base of each suction riser of four feet or more. The suction trap must be the same size as the suction line. Additional traps are necessary for long vertical risers. Add a trap for each length of pipe (approximately 20 feet) to insure proper oil return. Suction lines must slope ¼” per 10 feet toward the compressor. Install a suction line trap at the evaporator outlet if the suction line rises to a point higher than the connection on the evaporator.

Drain Lines:

Evaporator coil drain lines should be pitched a minimum of ½” per foot to allow proper drainage and exit the walk-in as quickly as possible. Insulate and seal the drain line where it passes through the wall. Copper drain line is required. If the refrigerated space is 33°F or lower, drain line insulation and heat tape are required. Drain lines must be insulated with minimum ½” thick arm aflex. The drain line heat tape must be wrapped around the copper drain line. Do not locate bends, elbows, or drain traps within the refrigerated space. Do not reduce the drain line size. Locate a drain line Ptrap outside of the refrigerated space. Any traps exposed to low ambient temperatures should be wrapped with a drain line heater (provide 20 watts of heat per foot of drain line at 0°F, 30 watts per foot at -20°F.

Self-check 2	Written test

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

Test I Short Answer Questions

1. What are the clearance requirements?(4pts)
2. What are the General guidelines locating and mounting evaporator coil?(8pts)

Note: **Satisfactory rating - 12 points** **Unsatisfactory - below 12 points**

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

Information sheet 3 - Completing commissioning tests

3.1. Completing commissioning tests

3.1.1. Start-Up Procedure plate cooler

- Operate the system for a minimum of two hours and perform checks of the following:
- Check the compressor discharge and suction pressures to ensure they are in the normal operating range.
- Check the liquid line sight glass for proper refrigerant charge.
- Monitor the compressor oil level (semi-hermetic compressors), add oil as necessary to keep the level at ¾ sight glass when idle and ½ sight glass when running.
- Check the voltage and amperage at the compressor terminals. Voltage must be within +10% or -5% of the rating indicted on the condensing unit name plate. On three phase compressors, verify there is a balanced load.
- Check all fans on the evaporator coil and condensing unit to be sure they are operational and turning in the correct direction.
- Check the piping and electrical connections for vibration. Add supports and strapping if needed.
- Check the crankcase heater operation (if equipped).
- Set the defrost control time and verify the defrost initiation settings.
- Check the compressor and evaporator superheat

After all system checks have been checked, properly adjusted, and verified, replace all Schrader caps, service valve caps, electrical box covers, housings, etc. File a copy of this manual for future reference.

3.1.2. Operational Start-Up refrigerator

The first 2 – 4 hours of operation after initial start-up is a critical time. Do not just start the system and leave. Pressure values, compressor and evaporator superheat, and inspecting for excessive vibrations and loose connections are some of checks that must be performed prior to leaving the system.

Pre-Start Checks:

- Verify that all service valves are fully open.
- Ensure that all refrigerant and electrical connections are tight.
- Verify that the wiring and piping is properly routed and secured.
- The compressor mounting bolts are properly adjusted
- All fan motors and mounting brackets are tight.
- The condensing unit base and evaporator coil are properly secured.

Leak Testing

After all connections are complete the refrigeration system must be tested for leaks. Failure to perform a leak test can result in unsatisfactory system performance, additional servicing and service costs, and possible system failure. Leak test should be performed using an electronic leak detector. All joints and components, both factory and field installed, should be thoroughly inspected for leaks. The system installation must be leak free!

Leak Testing "PR" model systems:

- Open both the liquid and suction service valves.
- Ensure the solenoid valve is energized and open.
- Add 50 psi refrigerant, then pressurize with dry nitrogen to the low side test pressure identified on the unit rating label.
- Allow thirty minutes for refrigerant to reach all parts of the system.
- Check all joints and components with an electronic leak detector.

Leak Testing "PC" model systems:

- Leave the service valves closed, the condensing unit is charged with refrigerant.
- Ensure the solenoid valve is energized and open.
- Add 50 psi refrigerant, then pressurize with dry nitrogen to the low side test pressure identified on the unit rating label.
- Allow thirty minutes for refrigerant to reach all parts of the system.
- Check all joints and components with an electronic leak detector.

Leak Testing "PCL" model systems:

- Open both the liquid and suction service valves.
- Ensure the solenoid valve is energized and open.

- Allow thirty minutes for refrigerant to reach all parts of the system.
- Check all joints and components with an electronic leak detector.

If a leak is detected, relieve the pressure and/or reclaim the refrigerant and repair the leak. If additional brazing is required, pass a dry inert gas (nitrogen) through the system to prevent contamination. Reference page 10 of this manual for leaks located at quick connects couplings. Retest the system as outlined above until no leaks are detected.

CAUTION

If a braze joint is detected leaking, dry inert gas must be passed through the system while repairing the joint to prevent scaling and oxidation. Scaling and oxides can clog refrigeration components resulting in system failure.

Always use the system specified refrigerant when pressuring to perform a leak test.

System Evacuation

Evacuation of the refrigeration system is necessary to remove all air and moisture from the system. A reliable rotary vacuum pump with an accurate deep vacuum gauge is recommended. Do not use the system compressor as a vacuum pump and do not operate the compressor while the system is under vacuum.

Evacuation of "PR" model systems:

Open both the liquid and suction service valves.

- Ensure the solenoid valve is energized and open.
- Connect vacuum pump to the liquid and suction service valves.
- Evacuate the system to 250 microns and maintain for a minimum of 4 hours.
- Perform a vacuum decay test for a minimum of ten minutes to ensure the system is leak free and dry.

Evacuation of "PC" model systems:

- Leave the service valves closed, the condensing unit has been evacuated and is charged with refrigerant.
- Ensure the solenoid valve is energized and open.
- Connect vacuum pump to the liquid and suction service valves.
- Evacuate the system to 250 microns and maintain for a minimum of 4 hours.

- Perform a vacuum decay test for a minimum of ten minutes to ensure the system is leak free and dry.

Evacuation of "PCL" model systems:

- "PCL" systems do not require evacuation; this process has been performed at the factory.

CAUTION

Do not use the system compressor to evacuate the system. Do not start the compressor while the system is under vacuum. This may damage to the compressor and cause premature system failure.

Self-check3	Written test

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

Test I Short Answer Questions

1. How to testing leak of refrigerator by used “PR” model systems? (8points)
2. What are the start-up procedure plates cooler? (8points)

Note: **Satisfactory rating - 16 points** **Unsatisfactory – below16 points**

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

Information sheet 4 - Completing routine maintenance program requirements

4.1. Completing routine maintenance program requirements

Equipment should be in good repair and proper adjustment such that:

- Equipment components such as doors, seals, hinges, fasteners, and kick plates should be kept intact, tight, and adjusted in accordance with manufacturers' specifications.
- Culling or piercing parts of can openers should be kept sharp to minimize the creation of metal fragments that can contaminate food when the container is opened.

Area	Task	Frequency
Evaporator	Check for proper defrosting	Monthly
	Clean the coil and drain pan	Every 6 months
	Check for proper drainage	
Condenser	Condenser Inspect /clean the coil if the air supply is near polluting sources (such as cooking appliances)	Monthly
	Clean the coil surface	Every 3 months
General	General Check/tighten all electrical connections	Every 6 months
	Check all wiring and insulators	
	Check contactor for proper operation and contact point deterioration	
	Check all fan motors	
	Tighten fan set screws, and motor mount nuts and bolts	
	For semi-hermetics, check the oil level in the system	
	Check the operation of the control system	
	Make certain all safety controls are operating properly	
	Check operation of the drain line heater and examine for cuts and abrasions	
	Check/tighten all mechanical/flare connections	

Table 4 Maintenance Chart

CAUTION

Failure to keep the condenser coil clean will result in reduced airflow through the condenser, resulting in poor system performance and premature compressor failure.

Polyol Ester (POE) Lubricants:

Polyol Ester (POE) lubricants quickly absorb moisture from the ambient surroundings. POE lubricants absorb moisture more rapidly and in greater quantity than conventional mineral oils. Because moisture levels greater than 100 PPM will result in system corrosion and component failure, it is essential that system exposure to ambient conditions be kept to a minimum.

If a system is left open to the atmosphere for more than 15 minutes, the liquid line drier and compressor oil must be replaced. Drain at least 95% of the oil from the compressor suction port. Measure the amount of removed oil, and replace it with exactly the same amount of new POE oil.

Mobil EAL™ ARCTIC 22 CC is the preferred Polyol Ester lubricant because of its particular additives. ICI Emkarate RL 32S is an acceptable alternative when the Mobil is not available. These POE lubricants must be used with HFC refrigerants. Lubricants are packaged in specially designed, sealed containers. Once opened, use the lubricant immediately. Properly dispose of any unused lubricant.

Self-check 4	Written test

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

Test I Short Answer Questions

1. What tasks should be checked during maintenance? (12points)
2. Why lubricants should be done? (3points)

Note: **Satisfactory rating – 15 points** **Unsatisfactory - below 15 points**

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

Information sheet 5 - Storing and restocking animal by-product and cleaning work area

2.2. Storing and restocking animal by-product and cleaning work area

2.2.1. Storing and restocking animal by-product

The site is considered a handling site if receive raw ABPs and then:

- Sort, cut, chill, freeze, or salt them
- Remove hides and skins
- Remove specified risk material (animal body parts that pose specific disease risks, eg cows' spinal cords)
- Perform post-mortem examinations and take samples
- Pasteurize them before sending them to anaerobic digestion or composting sites

Store by product items under appropriate storage conditions, includes:

- Should be stored at correct storage temperature:
  - ✓ Frozen food must be stored in freezers operating at a temperature that will keep items hard frozen (-18^{O}C and below)
  - ✓ Refrigerated by products must be stored in the nominated cool rooms or refrigerators in the range of 2^{O}C to 4^{O}C
  - ✓ Dry food (milk powder) must be stored in a designated dry goods store for food in the range of 10^{O}C to15^{O}C.
- Food should not be stored with other items and must not be stored with chemicals and cleaning agents
- Ensure store rooms protect stock from contamination as appropriate to individual stock items. Protection is commonly required to guard against damage caused by weather, sunlight, airborne contamination (fumes and dust), and vermin
- Never place stock on the floor. Always put items in their allocated space, shelf, bin, and cupboard. This also helps prevent slips, trips and falls

- Keep the storage area well-lit and ventilated to deter pests and allow easy identification of stock items and problems
- Keep shelves, benches, pallets, bins in good order and inspect the area/fixtures and fittings on a regular basis for signs of damage or deterioration or other problems such as stability, security and pest infestation
- Protect by product stored at room temperature against contamination and conditions that could cause deterioration. This includes:
  - ✓ Direct sun
  - ✓ Excessive heating
  - ✓ Moisture
  - ✓ External contaminants
  - ✓ Rapid temperature changes that could affect their safety or quality

- Identify the hazards associated with storing the finished product.
- Make sure finished products are stored and handled under the proper conditions to prevent deterioration (such as spoilage) and damage (such as crushing or forklift damage).
- Store materials that are sensitive to humidity under humidity-controlled conditions.
- Keep refrigeration units including their condensate collection trays and drain lines clean and maintained on a regular schedule to prevent the growth of mold, spoilage bacteria and pathogens.
- Treat condensate trays with sanitizer to prevent the growth of harmful bacteria that could cross-contaminate employees' clothing or skin or other areas of your plant and eventually food products.
- Clearly identify each container, and make sure the stack of containers won't fall over. Make sure they are protected from pests, moisture and too much weight.
- Do not store any other products in by product storage rooms that may transmit odors or flavors.

2.2.2. Cleaning work area equipment and utensils

Frequent and effective cleaning of certain areas of the plant is necessary to:

- Prevent the accumulation of organic wastes resulting from meat and poultry operations on equipment and utensils.
- Prevent the development of foul odours that could attract insects, rodents, and other vermin.
- Remove product debris or dirt on non-food-contact surfaces that may provide an environment suitable for the growth of microorganisms that employees could indirectly transfer to the product. The method, frequency, and area to be cleaned may vary with plant operations.

All food-contact surfaces, including food-contact surfaces of utensils and equipment, must be cleaned and sanitized as frequently as necessary to prevent the creation of insanitary conditions and the adulteration of product. The establishment has the responsibility to ensure that:

- Utensils and equipment surfaces that contact exposed edible product are cleaned and sanitized on a schedule that prevents the creation of insanitary conditions and the adulteration of the product.
- Food-contact surfaces of utensils and equipment are cleaned and sanitized whenever there is a change from working with raw product or raw components to working with ready-to-eat products.
- Food-contact surfaces of utensils and equipment are cleaned and sanitized whenever they become contaminated during operation.

The Seven Steps of wet sanitation process

A. Sanitation preparation

- Remove production supplies from the room ⁄ All ingredients, food products, packaging materials,
- Empty & remove garbage and scrap containers
- Purge process lines
- Empty drain baskets by dedicated personnel

B. Pre-rinse

- Rinse to remove visible soils
- Consider the water temperature & pressure

C. Clean

Different approaches of cleaning:

- Foam cleaning
- Manual cleaning
    - ✓ Manually scrubbing may be
    - ✓ required to remove heavy soils

D. Rinse & inspect

Rinse to remove chemicals & soil:

- Rinse in the order that soap was applied – walls, floor and then equipment
- Rinse equipment from top to bottom
- Avoid spraying floor once post rinse of equipment begin

E. Remove & assemble

- Verify all chemical is removed (sight, pH paper)
- Remove all standing water and overhead condensation
- Inspect parts that will not be accessible after assembling
- Sanitize inaccessible parts prior to assembling
- Assemble: follow lock-out/tag-out (LOTO) procedures
- Re-lubricate where needed

F. Pre-operation inspection & verification

- Inspect that equipment is free of chemicals, tools and cleaning supplies
- Inspect that guards are in place before starting equipment
- Run equipment prior to inspecting

G. Sanitize

- Verify no standing water
- Measure concentration using test kits
- Flood sanitize entire processing area
- Walls, floors and equipment
- Ensure equipment is running

Self-check 5	Written test

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

Test I Short Answer Questions

1. What are the seven steps of wet sanitation process? (6pts)
2. What are the storage conditions to store by product items (12pts)

Note: **Satisfactory rating – 18 points** **Unsatisfactory - below 18 points**

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

Operation Sheet 1	Start-Up check of plate cooler

Objectives

- To perform startup check
- To operate plate cooler

Equipment

- Volte meter
- Refrigerator
- Power source
- PPE

Procedures

1. Operate the system for a minimum of two hours and perform checks of the following:
2. Check the compressor discharge and suction pressures to ensure they are in the normal operating range.
3. Check the liquid line sight glass for proper refrigerant charge.
4. Monitor the compressor oil level (semi-hermetic compressors); add oil as necessary to keep the level at ¾ sight glasses when idle and ½ sight glasses when running.
5. Check the voltage and amperage at the compressor terminals. Voltage must be within +10% or -5% of the rating indicted on the condensing unit name plate. On three phase compressors, verify there is a balanced load.
6. Check all fans on the evaporator coil and condensing unit to be sure they are operational and turning in the correct direction.
7. Check the piping and electrical connections for vibration. Add supports and strapping if needed.
8. Check the crankcase heater operation (if equipped).
9. Set the defrost control time and verify the defrost initiation settings.
10. Set temperature control to desired temperature range.
11. Check the compressor and evaporator superheat

Operation Sheet 1	Pre-Start Checks of refrigerator

Objectives

- To perform startup check
- To operate plate cooler

Equipment

- Volte meter
- Refrigerator
- Power source
- PPE

Procedures

1. Verify that all service valves are fully open.
2. Ensure that all refrigerant and electrical connections are tight.
3. Verify that the wiring and piping is properly routed and secured.
4. The compressor mounting bolts are properly adjusted
5. All fan motors and mounting brackets are tight.
6. The condensing unit base and evaporator coil are properly secured.

LAP TEST	Performance Test

Name…… ID…… Date……

Time started: _____ Time finished: _____

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

Task 1

Performing startup check

Operating plate cooler

Task 2

Performing startup check

Operating refrigerator

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20. Rendering animal fat, bones, and meat scraps—are classified in U.S. Industry 311613, Rendering and Meat By-product Processing;
21. Manufacturing canned meats for baby food—are classified in U.S. Industry 311422, Specialty Canning;
22. Manufacturing meat-based animal feeds from carcasses—are classified in Industry 31111, Animal Food Manufacturing;

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