Dairy product processing -Level-II Based on October, 2019 Version 2 Occupational standards

Module Title: Operating a Butter Churning and Oil Production Process

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L #36	LO #1-Prepare the butter churning and butter oil equipment and process for operation

Instruction sheet

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

- Confirming and making available materials
- Identifying and confirming cleaning and maintenance requirements
- Fitting and adjusting machine components and attachments
- Entering processing/operating parameters
- Checking and adjusting equipment performance
- Carrying out pre-start up checks

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

- Confirm and make available materials
- Identify and confirm cleaning and maintenance requirements
- Fitting and adjusting machine components and attachments
- Entering processing/operating parameters
- Checking and adjusting equipment performance
- Carrying out pre-start up checks

Learning Instructions:

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

Information Sheet 1- Confirming and making available materials

1.1 Confirming and making available materials

Butter essentially the fat of milk. It is usually, made from sweet cream and salted. However, it can also made from **acidulated** or **bacteriologically soured cream** and salt-less (sweet) butters are also available. Well into the 19th century, butter still made from cream that allowed stand and sour naturally.

Butter a dairy product that you obtain by churning milk or cream. The butter making process involves a series of activities aimed at separating the milk fat from the liquid phase and converting it into a solid phase.

The cream skimmed from the top of the milk and poured (transferred) into a wooden tube, Butter making done by hand in butter churns or machine churner.

The natural souring process is, however, a very sensitive one and infection by foreign microorganisms often spoiled the result.

Today's commercial butter making is a product of the knowledge and experience gained over the years in such

- Matters as hygiene
- Bacterial acidifying
- Heat treatment
- Rapid technical development that has led to the advanced machinery now used.
- The commercial cream separator introduced at the end of the **19th century**
- The continuous churner commercialized by the middle of the **20th century**.

1.2 Fermented Milk for Butter making

- Man has used milk and milk products, since **prehistoric (ancient) times**.
- There is evidence that butter made as far back as 2000 BC.

It thought, that **cheese** making was discovered accidentally and initially developed in **Iraq** circa 7000–6000 BC and spread with the migration of populations due to

- Famines

- Conflicts
- Invasions.

Examples of these migrations are

- The development of Swiss cheeses by the Helveti tribe in Switzerland
- The introduction of cheese making into England by the Romans.

Cheese varieties peculiar to each region developed because of the different agricultural conditions prevailing in each country. There are, at present, almost 2000 recognized varieties of cheese.

Butter is a water in oil emulsion with the milk proteins acting as the emulsifiers.

- At refrigeration temperatures, butter remains a **firm solid**
- It is **softens** into a spreadable consistency and melts into a **liquid** at relatively **low temperatures**.

In the butter making process, you can choose product that you desire

- **Sweet cream** Sweet cream is a fresh cream without any developed acidity
- **Sour cream** aged cream has developed acidity

The main section of any milk processing plant was the milk processing **equipment's**, It helps to perform the various operations and working on milk production such as storing milk, clarification, homogenization, separations, pasteurization and some other operations.

In modern days, the all milk-processing equipment have become, more advanced with some latest and unique techniques. These advanced high technology machines are very useful for farmers for good quality milk production without more human efforts. The milk processing equipment designed and developed to consider all farmers' needs

The milk processing machines have a great role to make dairy industry one of the major food industries all over the world.

There are various milk-processing machines helpful in dairy plants to produce best Products Like

- Cheese
- Milk

- Butter
- Yogurt
- Ice Cream and Much more similar products

Fermented milks have been prepared for more than 2000 years. Allowing milk to ferment naturally gives an acidic product that does not putrefy.

Fermented milks are wholesome and readily digestible; examples of such products are

- Yoghurt
- Kefir
- Koumiss
- Acidophilus milk.

1.3 Cream milk for Butter making

The development of the milk separator in the **19th century** made centralized milk processing possible. Initially

- Cream was separated, and retained for **butter making**
- The fresh **skim milk** returned to the milk producers.

As the nutritional importance of the non-fat component (skim milk) became recognized, processes developed to conserve milk solids-not-fat (SNF). Casein and casein products as well as lactose and dried milk were prepared.

Today, up to 60% of the milk produced in the world converted into dehydrated milk products and foods containing a large proportion of milk solids.
In countries with commercial dairying these processes are carried out in large capacity processing plants.
In Africa, milk produced in most agricultural production systems. It is, either sold fresh consumed as fermented milk or manufactured into products such as:

- Butter
- Ghee
- Cheese.

Sour milk is the most common product, and milk usually soured before further

processing. While there are several milk-processing plants in Africa, much of the milk produced by **rural smallholders** is processed on-farm using **traditional technologies**. It is important, therefore, to consider these processes and look to possible technological interventions at this level when considering dairy development in the rural sector.
Farmers in many African countries produce

- Sour milk
- Butter
- Cottage cheese for home consumption and sale.

Milk processed primarily to convert it into a more **stable product**

- Fermented milk can be stored for about 20 days compared with less than one day for fresh milk.

Milk products are more stable than fresh milk because they are more acidic and/or contain less moisture Preservatives,

- Salt added to milk products. Thus, by increasing the acidity and reducing the moisture content, the storage stability of milk increased.

1.4 Anhydrous Milkfat (butter oil)

Anhydrous milk fat, butter oil manufactured from either butter or from cream. For the manufacture from butter, non-salted butter from sweet cream is normally used, and the process works better if the butter is at least a few weeks old.

Melted butter passed through a centrifuge, to concentrate the fat to 99.5% of greater. This oil is heated again to 90-95oC and vacuum cooled before packaging.

The commercially prepared extraction of cow's milkfat, found in bulk or concentrated form (comprised of 100% fat, but not necessarily all of the lipid components of milk).

1.5 Butter oil

Equal with anhydrous milkfat; (conventional terminology in the fats and oils field differentiates an oil from a fat based on whether it is liquid at room temp. or solid, but very arbitrary).

1.6 Pasteurization of cream

- The process of heating every particle of **cream** not less than 70°C for 20 min or 80°C/25 s.
- It is a satisfactory and economical method for small-scale operations, but is not practicable for larger scale operation.
- The **cream** heated to 70°C for 20 minutes and then promptly cooled.

1.7 Buttermilk

- fermented dairy drink
- Traditionally, it was the liquid left behind after churning butter out of cultured cream; however, most modern buttermilk is cultured.
- It is common in warm climates
- Traditionally, before the advent of homogenization, the milk left to sit for a period to allow the cream and milk to separate.
- During this time, naturally occurring lactic acid-producing bacteria in the milk fermented it.
- This facilitates the butter churning process, since fat from cream with a lower pH coalesces more readily than that of fresh cream.
- The acidic environment also helps prevent potentially harmful microorganisms from growing, increasing shelf life

1.8 Washing the butter

When the desired grain size obtained, the buttermilk drained off and the butter washed several times in the churn. Each washing done by adding only as much water as is needed to float the butter and then turning the churn a few times. The water then drained off.

As a general rule two washings are enough but in very hot weather three may be necessary before the water comes away clear. In the hot season the coldest water available should used for washing, and in the cold season water about 2 to 3°C colder than the churning temperature should be used

1.9 Salting, working and packing the butter

Equipment for working may consist of a butter worker or a tub or keeler. Good-quality spatulas are important, and a sieve and scoop facilitate the removal of butter from the churn. This equipment must be clean.

The butter is spread on the worker, which has been previously soaked with water of the same temperature as the washing water.

If salted butter is required, it should salted before working at a rate of 16 g salt/kg or according to taste.

Salt added to butter most commonly using the dry-salting method in which dry salt is sprinkled evenly over the butter and worked in. The salt used should be dry and evenly ground and of the best quality available.

The butter is then either rolled out 8-10 times or ridged with the spatulas to remove excess moisture.

Adding salt to butter disturbs the equilibrium of the emulsion (the butter). This in turn changes the character of the body and alters its color. Unless the butter subjected to sufficient working to regain the original equilibrium of the emulsion, it will tend to have a coarse, leaky body and uneven color.

The butter should worked until it seems dry and solid, but it must not worked too much or it will become greasy and streaky.

Butter must adequately worked if it is to be stored for a long time. First, working distributes the salt uniformly in the moisture and this helps inhibit microbial growth. Secondly, it distributes the salt solution into many tiny droplets rather than fewer large ones. For a given level of microbial contamination, the microbes will be more isolated in small droplets and will have less of the butter's nutrients available to them for growth.
Surplus good-quality butter can be stored, but should contain more salt than usually at least 30 g/kg and a low moisture content (14--15%).

The butter must packed in clean containers, such as

- seasoned boxes or glazed crocks
- Stored in a cold room or in a cold, airy place.
- If a box is used, it should be lined with good-quality polythene
- The container should filled capacity from one churning.
- The more firmly butter is packed, the better; it may be covered with a layer of salt, but this is not essential.
- The container should securely covered with a lid or a sheet of strong paper and stored in a cool, dark place.

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 1point)

1._____ is a water-in-oil emulsion with the milk proteins acting as the emulsifiers.

A. Cheese B. Yoghurt C. **Butter** D) None

2. The commercial cream separator was introduced at the end of the ----- century.

A. 20th B) **19th** C.21th D None

3. Which one of the following are/is best dairy products in dairy plants

A. cheese and milk B. Butter and yogurt C. Ice cream D. **All**

4. Which one of the following are/is the most milk product of many African countries?

A. Sour milk B. Butter C. Cottage cheese for home consumption and sale **D. All**.

5. ____Melted butter passed through a centrifuge, concentrate fat 99.5% and greater

A. Butter B. Cheese C. Cream D. Butter oil.

6. _____the process of heating every particle of **cream** to not less than 70°C for 20 min or 80°C/25 s.

A. Butter making from Cream B. cream fermentation

C. Butter washing **D. pasteurization of cream**

7. Which one of the following milk product called fermented dairy drink?

A. Cheese B. Butter C. buttermilk **D. All**

Part II fill the blank space

1. List down the most common butter packing containers and storage system! (5%)

_____,_____

_____,_____

_____,_____

2. Mention the most milk product in Africa agricultural systems! (3%)

_____,_____,_____

Answer the following question!

Note: **Satisfactory rating - 8 and 15 points Unsatisfactory - below 8and 15points**

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

Answer Sheet

Name: _____ Date: _____

Score = _____

Rating: _____

Information Sheet 2- Identifying and confirming cleaning and maintenance requirements

2.1 Identifying and confirming cleaning and maintenance requirements

2.1.1 Butter churner Cleaning procedure

- The churn and butter making equipment should washed as soon as possible, preferably while the wood is still damp in the case of wooden churns.
- Wash the inside of the churn thoroughly with hot water.
- Invert the churn with the lid on in order to clean the ventilator; this should be pressed a few times with the back of a scrubbing brush to allow water to pass though (NB the ventilator should be dismantled occasionally for complete cleansing).
- Remove the rubber seal from the lid and scrub the groove. Scald the inside of the churn with boiling water or steam
- . Invert and leave to dry. Dry the outside and treat metal parts with food grade grease or Vaseline to prevent rusting.
- The rubber seal should placed in boiling water or dipping in warm water with disinfectant is enough.

2.1.2. Milk pumps cleaning

Generally, follow manufacturer's instructions and lubrication according to procedures outlined

2.1.3 Cleaning butter making equipment

- Cream prepared by gravitational or mechanical separation can used to make butter.
- Good butter can made in any type of churn provided, it is clean and in good repair.

2.2 Cleaning Churning Equipment

A. The churn prepared for butter making by:-

- Rinsing with cold water
- Scrubbing with salt

- Rinsing again with cold water.
- Alternatively, it can scalded with water at 80°C.

B. After the butter removed, the churn should be

- washed well with warm water,
- Scalded with boiling water and left to air.
- When not in use wooden churns should be soaked occasionally with water.

C. A new churn should first be:

- washed with tepid water
- scrubbed with salt
- **Washed** with hot water until the water comes away clear.
- A hot solution of salt should allowed standing in the churn for about ten minutes.
- After rinsing again with hot water the churn should left to air for at least one day before being, used.

2.3 Maintaining Churner

- Driving gear should filled with lubricating oil and every alternate year replace it.
- While the churner is running, never change the speed of churner
- Solid foundation is necessary.
- Gaskets to be maintained leak proof.
- Proper roughness inside of the churner should maintained.
- Proper cleaning of the churner before and after the operation completed

2.4 Maintaining Milk separator

- The gears must well lubricated according to manufacturer's instructions.
- The level of the lubricant must be kept constant;
- Observe the oil level through the sight glass.
- The bowl must carefully balance.
- The bowl should cleaned thoroughly as immediately after use to ensure proper functioning of the separator and for hygiene.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Fill the blank space

1. List down the producer of preparing churner for butter making! (4%)

_____,_____

_____,_____

2. List down the producer of preparing new churner for butter making! (4%)

_____,_____

_____,_____

3. Mention the parts of churner require maintenance after operation! (4%)

_____,_____

_____,_____

_____,_____

. Answer the following question!

Note: **Satisfactory rating - 7 and 12 points Unsatisfactory - below 7and 12 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Question

Information Sheet 3. Fitting and adjusting machine components and attachments

3.1 Fitting and adjusting machine components and attachments

3.1.1 Butter Churner

Machine used to get butter by churning fermented milk or cream to separate the butterfat from the buttermilk.

The agitation of the cream or fermented whole milk caused by the mechanical motion of the device disrupts the milk fat. The membranes that surround the fats are broken down, subsequently forming clumps known as butter grains.

The butter grains, during the process of churning, fuse with each other and form larger fat globules. Called butter. For proper function of churner machine fitting and adjusting machine components and attachments mandatory.

3.1.2 The churner machine components

A. Churner body cover.

The cover of the butter churner is sheet of stainless steel that folds to fit the body with negligible loss of milk during churning and it has handle to open and close.

3.1.2 Churner body

The body of the butter churner is the part, which takes or carries the fresh or fermented cream

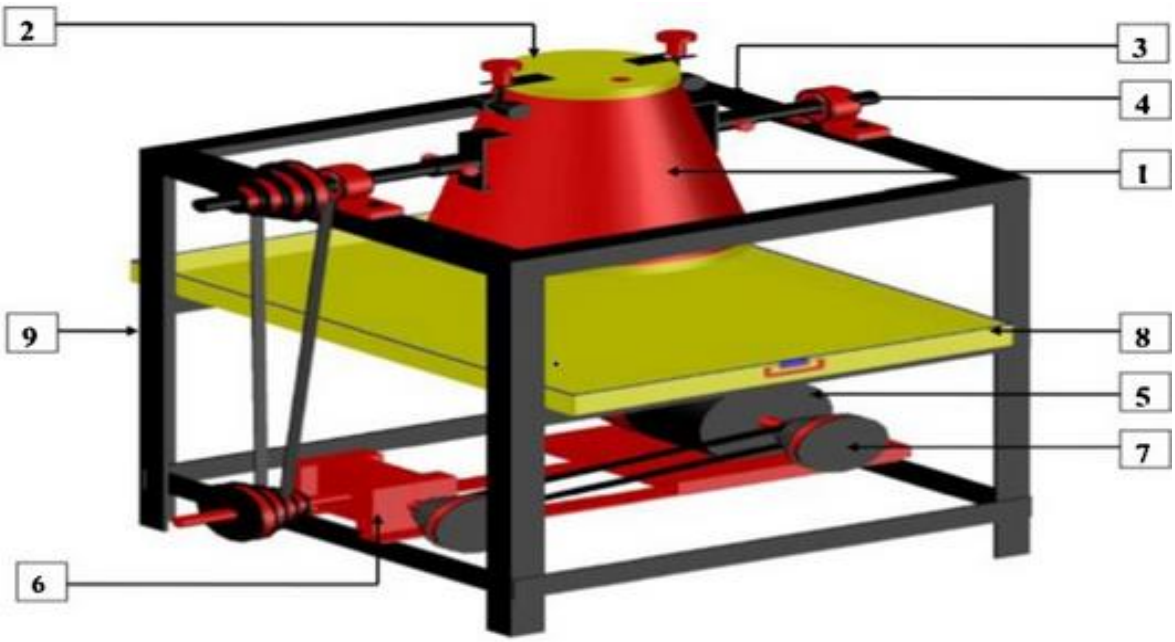
B. Adjusting Churning temperature gauge.

- The temperature of the cream during churning has great importance.
  - ✓ If too cool, butter formation delayed and the grain is small and difficult to handle.
  - ✓ If the temperature is too high, the butter yield will be low because a large proportion of the fat will remain in the buttermilk, and the butter will be spongy and of poor quality.
- Cream should churned adjusting the machine temperature gauge.
  - ✓ At 10--12°C in the hot season and
  - ✓ At 14--17°C in the cold season.

- The temperature raised by standing the vessel containing the cream in hot water, and lowered by standing the vessel in cold spring water for a few hours before the cream churned.
- The churning temperature adjusted by the water used to dilute the cream.
- In the hot season, the coldest water available should be used, preferably water that has been stored in a refrigerator.

C. The amount of cream to churned

- The amount of cream to churn should not exceed **one-half** the volumetric capacity of the churn.
- An airtight churn should ventilated frequently during the first **10 minutes** of churning to release gases driven out of solution by the agitation.
- If butter is slow in forming, adding a little water which is warmer than the churning temperature, but never over 25°C, usually causes it to form more quickly. When the butter appears like wet maize meal, water (1 liter per 4 liters of cream) at 2°C below the churning temperature should added.
- It may be necessary to add water a second time to maintain butter grains of the required size.
- Churning should cease when the butter grains are the size of small wheat grains.



1. Butter churn body	4. Bearing	7. Step down pulley
2. Head & closure	5. Motor	8. Tray
3. Shaft	6. Gear box	9. Stand

Figure1: Churner

3. 2 fitting and Adjusting (Assembling) Cream separator

- Put the bowl cover pin assembly back to gather
- Sure the bowl fit base notch
- Tighten the bowl nut well
- Place the milk contact parts over the spindle
- Starting with milk spout. Next place the bowl assembly making sure it seats properly on the tapered head of the spindle shaft.
- Put the cream spout on the next place the float chamber
- Next to float chamber put the milk tank “ON” the float chamber
- Make sure the milk tank is placed with on label at the front
- Tighten the tank tap handle put the tap in “OFF” position
- Your separator is now ready for use.

Figure 2. Electric cream separator machine

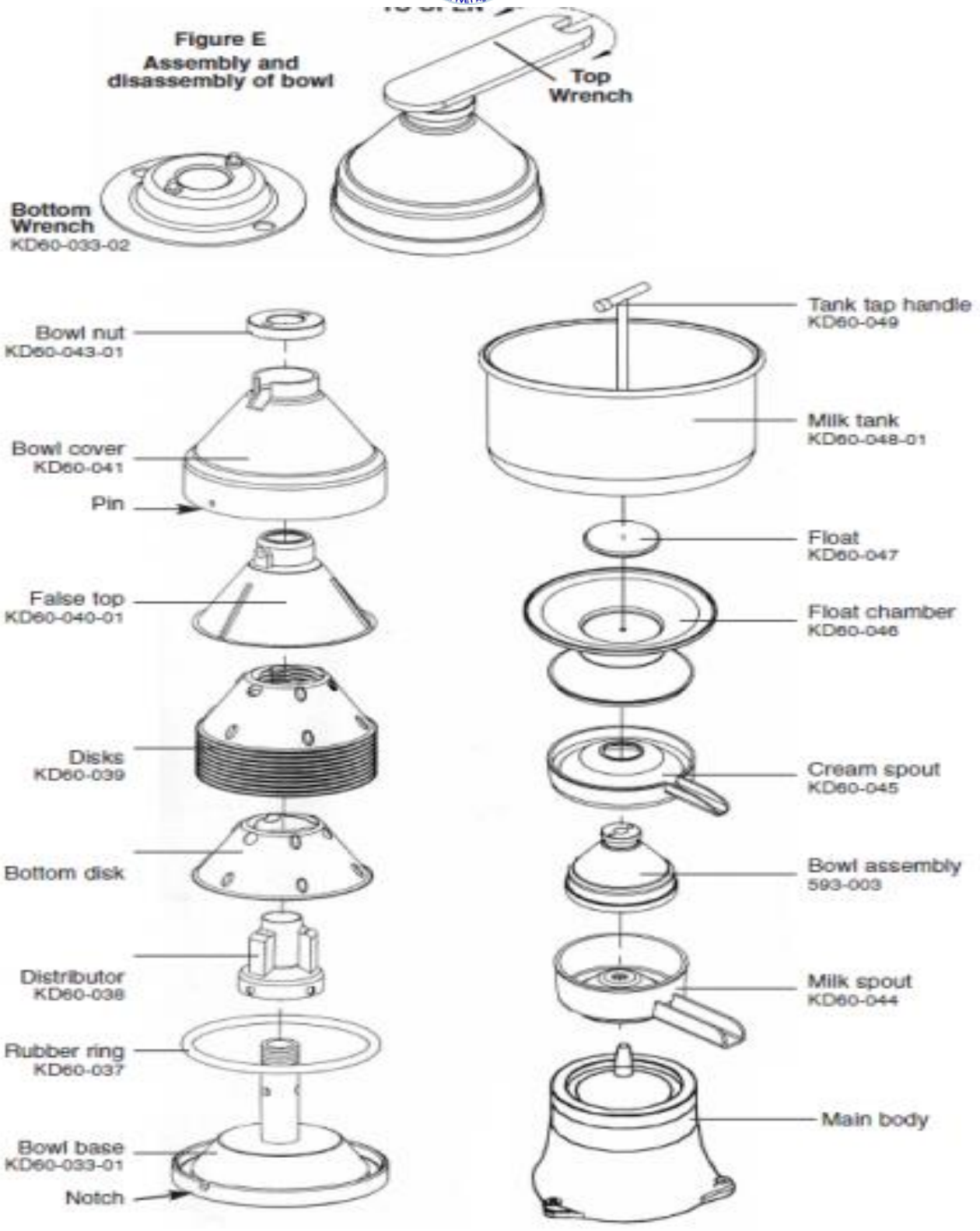


Figure 3 Electric cream separator machine spare part

Self-Check 3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 2 point)

1._____ Machine used to separate fermented milk or cream to form butterfat and buttermilk.

A. Homogenizer B. Pasteurizer C. Separator **D) Churner**

2. Which one of the following is/are correctly matched about churner temperature and season?

A. In hot season churner temperature 10--12°C **C. A and B**

B. In cold season churner temperature 14--17°C D. None

3. During you operate churner to produce butter from fermented milk or cream what amount of fermented milk or cream must added to the churner?

A. One- fourth of churner capacity C. one-half of churner capacity

B. Three fourth of churner capacity D. full capacity of churner

4. An airtight churn should ventilated frequently during the first-------of churning to release gases driven out of solution by the agitation.

A. 20 minutes B. 10 minutes C. 35minutes D All

5. Which part of the churner takes or carries the fresh or fermented cream

A. Churner body cover B. Churner body C. **Churner temperature gauge** D. All

. Answer the following question!

Note: **Satisfactory rating - 7 and 12 points Unsatisfactory - below 7and 12points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 4- Entering processing/operating parameters

4.1. Entering processing/operating parameters

A. Milk preparation and operation

- Milk must be strained to remove any dirt or particle
- Milk must not be cold, homogenized or Sour
- For best results, separate milk right out of the cow. If that is not possible rewarm the milk to approximate cow body temperature 100^0F(38^0C)
- It is very important that the milk is warm and stays warn though out the separating process
- Pre warm the separator as follow
  - ✓ Heat approximately 8 quarters (7lit) of hot water to 150^0F (66^0C)
  - ✓ Pour about 4 quarter of hot water into the tank.
- Place the containers under the spout to catch the water
- Open the tap and turn the machine on. Therefore, the hot water flows through the separator, and warms all the milk contact parts and close the tap.
- Now pour 6 quarter (6lit) of warm milk in the tank.

Make sure you have in place adequately sized containers to receive the cream and skimmed milk, which, will come out of the spout

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I fill the blank space

1. List down the most common procedures milk preparation and operation in cream separation process! (5%)

_____,_____

_____,_____/_____

_____,_____

_____,_____,_____

Answer the following question!

Note: **Satisfactory rating 3 and 5 points** **Unsatisfactory below 3 and 5 points**

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

Score = _____
Rating: _____

Answer Sheet

Name: _____ Date: _____

Information Sheet 5.Checking and Adjusting equipment Performance

5.1 Checking and adjusting equipment Performance

A) Best Butter Churn for Domestic Butter Making

I) Kilner Butter Churn, 34-Fluid Ounce Capacity

Figure 4: Manual churner

Butter making does not have to be an expensive affair. You can attain industrial quality butter by using a light duty machine in your kitchen.

Kilner Butter Churner is a no-brainer machine when it comes to domestic butter making. It converts cream into a fresh delicious butter in a matter of minutes.

This machine brings the nostalgia of making butter the traditional way right in your kitchen. You will be able to control the entire process and moderate the additional ingredients that you may need to incorporate in the butter. It comes with a recipe pamphlet that you can use to make different varieties of butter.

The Kilner Butter Churner is simple to use. It comes with a dishwasher safe jar and paddles that are easy to clean and maintain.

It also comes with a user manual with easy to follow instructions. Once you assemble the machine, you will be ready to start churning your butter right away.

Point to note:

- The glass jar is fragile. Needs careful handling.

Advantages

- Simplistic design is easy to use and maintain.
- Glass jar is dishwasher friendly and inert
- Strong paddles won't break during churning

II) PROFESSIONAL Electric 220V 15LT. Capacity Dairy Butter Churn

Figure 5: Electric churner

This Electric Butter Churn machine eliminates the hard manual work, as the motor rotates the churning blades to produce butter.

- You only need to press the button and watch as the machine converts the cream into butter and buttermilk.
- It has a capacity of 15 ltrs and comes fitted with three-propeller turbulence system that does the work of converting cream to butter.
- The system is easy to work with since the propellers can be easily dismantled, and cleaned by hand.
- The propellers are powered by a 2000 watts motor that provides enough power to

churn the 15 ltrs at full capacity

- Inner parts are made of food grade stainless steel for hygiene and ease of handling.

Point to note:

- The system comes fitted with a European standard 220V top plug. You may need a converter if your outlet and mains voltage is different.

Advantages

- Easy to use, clean, and maintain. Parts are easy to dismantle and comes with a user manual.
- The only challenge with the manual could be language structuring since the machine manufactured by a Turkish company English is not their first language.
  - ✓ Excellent customer support
  - ✓ Comes with a lifetime warranty
  - ✓ Manufacturer ships the item worldwide

5.2 Separators:

The separators mainly used for milk clarification,

- Pure milk fat
- Hot and cold milk separation

The unique feature of this equipment helps from air during entire process and gives us super product quality, as well as production flexibility and high separation efficiency.

Figure 6 Separators

5.3 Homogenizers:

The homogenizers the main equipment that plays the main role in achieving the different variety of product, improves the taste, texture and viscosity of juice based drink or cream and prevents a sedimentation and cream line in the milk products.

Figure 7: Homogenizers**:**

5.4 Milk Tanks:

- The milk tanks are prime components associated with milk production in processing type of business.
- There are various uses of milk tank in the dairy business.
- It used for store-standardized types of milk, skimmed milk or cream.
- The prestack tanks, interim tank, milk tanks and mixing tanks will always give you a good quantity of milk with all necessary characteristics.

Figure 8: Milk Tanks

5.5 Pasteurizers:

The pasteurization is very important in making of any product. The pasteurizers are the main milk processing equipment that provides the heat treatment to a product to reduce enzymatic activity and kill pathogenic bacteria.

The main purpose of using this equipment is to make product safe to lengthen product life and for consumption.

Figure 9. Pasteurizers

5.6 Centrifugal separation

- Gravity separation is slow and inefficient. Centrifugal separation is quicker and more efficient leaving less than 0.1% fat in the separated milk compared with 0.5--0.6% after gravity separation.
- The centrifugal separator invented in 1897. By the turn of the century it had altered the dairy industry by making centralized dairy processing possible for the first time
- . It also allowed removal of **cream** on the cream spout above and recovery of the **skim milk dropped on lower skim milk spout** in a **fresh state**.
- Milk enters the rapidly revolving bowl at the top, middle or bottom
- When the bowl is revolving rapidly, the force of gravity overcome by the centrifugal force, which is 5000 to 10 000 times greater than gravitational force.
- Every particle in the rotating vessel is subjected to a force which determined by the distance of the particle from the axis of rotation and its angular velocity.
- In gravity separation, the acceleration due to gravity is constant. In centrifugal separation, the centrifugal force acting on the particle can altered by altering the speed of rotation of the separator bowl.
- In separation, milk introduced into separation channels at the outer edge of the disc stack and flows inwards.

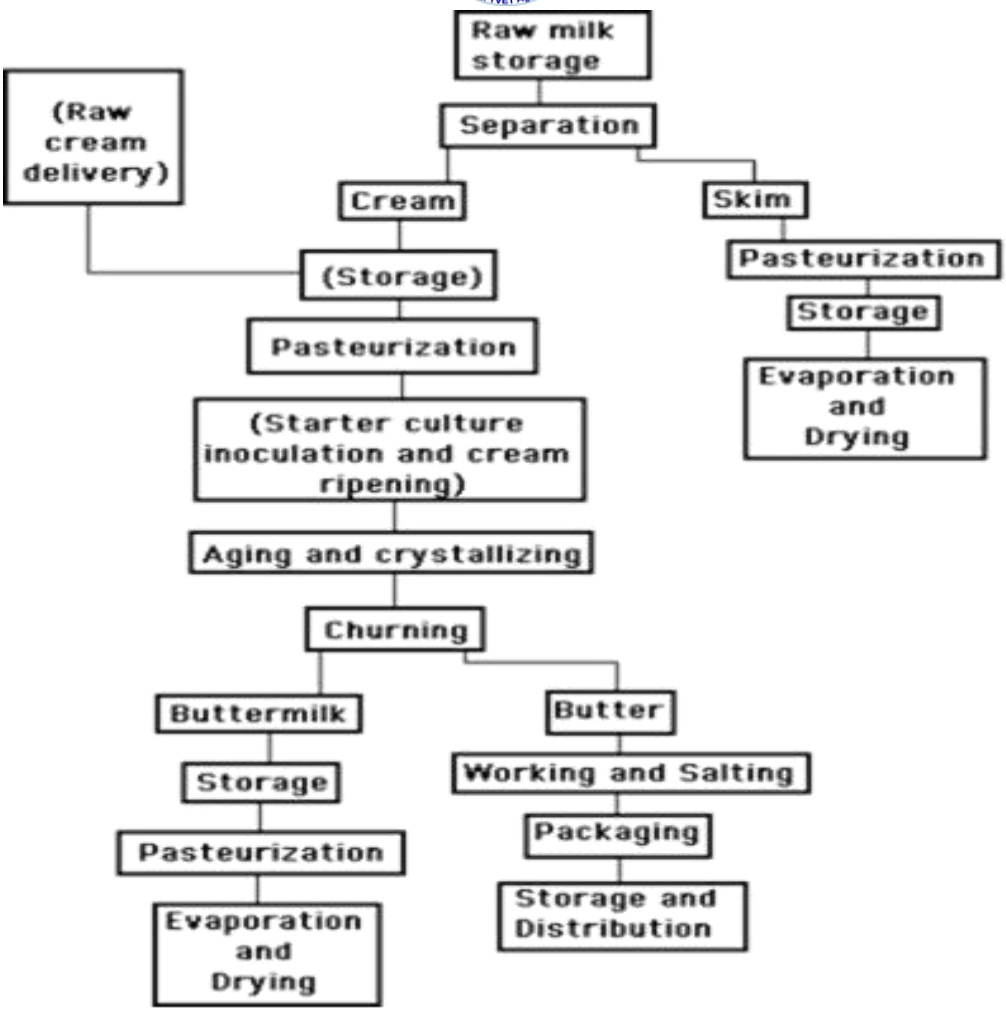


Figure 10 cream separator machine and cream separating operation

Self-Check 5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 2 point)

1._____ Machine used clarifying raw milk.

A. Homogenizer B. Pasteurizer **C. Separator** **D) Churner**

2._____ Machine used in achieving the different variety of product, improves the taste, texture and viscosity of juice based drink or cream and prevents a sedimentation and cream line in the milk products.

A. **Homogenize**r B. Pasteurizer C. Separator D) Churner

3._____ Machine used heat treatment to reduce enzymatic activity and kill pathogenic bacteria of milk.

A. Homogenizer **B. Pasteurizer** C. Separator D) Churner

4. What are the product of raw milk after passed through centrifugal separation?

A. Butter and buttermilk C. Buttermilk and Cream

B. Cream and skimmed milk D. All

. Answer the following question!

Note: Satisfactory rating 5 and 8 points **Unsatisfactory below 5 and 8 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Question

Information Sheet 6. Carrying out pre-start up checks

6.1 Carrying out pre-start up checks

The purpose of pre-start inspection to ensure that as equipment safe to use

A. There are three key objectives of pre-start inspection

- . First that the equipment inspected.
- Second, that identified faults or hazards reported and rectified.
- Third, that unsafe equipment taken out of service until it is safe to use.

B. Pre-start checking (inspecting) for dairy machine

- Check bolts and other loosen parts and tighten it before operation will start.
- When maintaining, inspecting, attaching and detaching parts, park the machine at flat and safe place
- Use proper tools to maintain the machine and check working area is safe during Operating
- Only allow responsible person, who are familiar with the instructions, to operate the machine
- Use only the machine for recommended work in the manual
- Take care when loading or unloading the machine
- Maintain the proper working speed.

C. After operation

- Remove remaining objects and wash in Agitating part, Body part and Drain Cap part.
- Fasten the loosen bolts and nuts after operation

6.2 Installation

- Poor machinery and equipment layout can face:
  - ✓ Blamed of many operating
  - ✓ Health and Safety problem
  - ✓ quality assurance problems in processing units
- Set the Churner on milk processing station
- Park the machine at flat and safe place to adjust operator's safety.

- When attaching components, take care of the components will in appropriate position and place.

To start the machine, first inspect the machine sensitive parts such as

- Bolts
- Drain
- Cap tightness
- Pins.

Self-Check 6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part II Fill the black space

1. Mention the three key of objective of pre-start inspection! (3%)

_____,_____

_____,_____

2. What are the operation procedure the operator must after perform after completing churner or cream separator operation? (2%)

_____

3. What are sensitive parts of Churner or cream separator machine first inspect to start (4%) the operation?

_____,_____

_____,_____

4. What types of problems occurred, if Poor machinery and equipment installation faced in work area? (3%)

B. Cream and skimmed milk D. All

. Answer the following question!

Note: Satisfactory rating 7 and 12 points Unsatisfactory below 7 and 12 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Operation title: -Fitting and adjusting (assembling) Cream separator machine

Purpose	To acquire the trainees with assembling cream separator operation and maintenance practice
Equipment ,tools and materials	Supplies and equipment needed or useful for fitting and adjusting cream senator include these: • Cream separator spare part • Top wrench • Oil for cream separator gear • Two bucket • Table • Electric power • Electric cable • Table • Raw milk
Conditions or situations for the operations	• All tools, equipment's and materials should be available on time when required. • Appropriate table, working area/ workshop to assemble cream separator practice.
Procedures	1. Put the bowl cover pin assembly back to gather 2. Sure the bowl fit base notch 3. Tighten the bowl nut well 4. Place the milk contact parts over the spindle 5. Starting with milk spout. Next place the bowl assembly making sure it seats properly on the tapered head of the spindle shaft. 6. Put the cream spout on the next place the float chamber 7. Next to float chamber put the milk tank "ON" the float chamber 8. Make sure the milk tank is placed with on label at the front 9. Tighten the tank tap handle put the tap in "OFF" position 10. Your separator is now ready for use. 11. Teste the machine as it is functional by adding milk
Precautions	• Care should be taken while connecting with electric power, assembling, fitting and adjusting the machine • Preparing materials, tools and equipment are according to inseminator command.
Quality criteria	• Did personal protective equipment worn while fitting and adjusting cream separator machine • Did trainees fitting and adjusting the component of the machine proper without leakage • The machine functional for cream separation

Fitting and adjusting (assembling) Cream separator machine

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions:

1. You are required to perform any of the following:
   1.1. **Fitting and adjusting (assembling) Cream separator machine to separate raw milk**
   1.2. Prepare equipment and **material for Fitting and adjusting (assembling) Cream separator machine operate the proper!**
2. Request your teacher for evaluation and feedback

LG #37	LO #2- Operate and monitor the butter churning and the butter oil process operation

Instruction sheet

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

- Starting and operating the process
- Monitoring equipment in operation
- Identifying and Maintaining variation of equipment in operation
- Monitoring stage process and Meeting confirmed specifications
- Identifying, rectifying and reporting out-of-specification product/process out comes
- Maintaining work area
- Conducting work with environmental guidelines
- Maintaining workplace

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

- Start and operate the process
- Monitor equipment in operation
- Identify and Maintain variation of equipment in operation
- Monitor stage process and Meet confirmed specifications
- Identify, rectify and report out-of-specification product/process out comes
- Maintaining work area
- Conduct work with environmental guidelines
- Maintain workplace

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, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1 Starting and operating the process

1.1 Starting and operating the process

- Butterfat recovered from milk or cream and converted to a number of products, the most common of which is **butter.**
- **Butter** is an emulsion of water in oil and has the following approximate composition:

No.	Butter content	%
1	Fat	80%
2	Moisture	16%
3	Salt	2%
4	Milk SNF	2%
	Total	100%

- In good butter, the moisture evenly dispersed throughout in tiny droplets.
- In most dairying countries legislation defines the composition of butter, and butter makers conform to these standards insofar as possible.

Butter made from either whole milk or cream; however, it is more efficient to make it from **cream.**

1.2 Classification of Butter

1. Based on the acidity of cream

1.1 Sweet cream butter----- No-acidified cream=PH of 6 ≥.4

1.2 Mildly acidified butter----Paircilly acidified sweet cream = PH 52.2 to 6.3

1.3 Sour cream butter---Ripened cream >0.2% acidity PH ≤5.1

2. Based on salt content

2.1 Salted Butter -----Improved Flavor and keeping quality

2.2 Unsalted butter ----Used for preparation of ghee and butter oil

3. Based on end use

3.1 Table Butter ---- Salt and Color (Annato/Carotene Flavor (Deacetylate)

3.2 White Butter ------No preservatives

Made from pasteurized cream obtained from cow or Buffalo milk with combination of above ingredient

4. Based on manufacturing Practice

4.1 Pasteurized cream/ Table Butter-made from pasteurized sweet cream

4.2 Desi Butter –Made by churning of Dahi/Malai

There are essentially four types of butter making processes:

A. Traditional batch churning from 25- 35% mf. cream;
B. Continuous flotation churning from 30-50% mf. cream;
C. The concentration process whereby "plastic" cream at 82% mf. is separated from 35% mf. cream at 55oC and then this oil-in-water emulsion cream is inverted to a water-in-oil emulsion butter with no further draining of buttermilk;
D. The anhydrous milkfat process whereby water, SNF, and salt emulsified into butter oil in a process very similar to margarine manufacture.

An optimum churning temperature must be determined for each type of process but is mainly dependent on the"

- Mean melting point and melting range of the lipids, 7-10oC in summer and 10 - 13oC in winter.
  - ✓ If churning temperature is too **warm** or if the thermal cream aging cycle permits too much liquid fat, then a **soft greasy (oily) texture** results
  - ✓ If too **cold** or too much solid fat, then butter becomes too **brittle (hard)**.

A. Traditional batch churning from 25- 35% milk fat. Cream

This is a very important process in many parts of Africa and countries with a developing dairy industry.

Smallholders produce one to four liters of milk per day for processing. Under normal storage conditions, the milk becomes sour in four to five hours. Souring milk has a number of advantages. It retards the growth of undesirable microorganisms, such as pathogens and putrefactive bacteria and makes the milk easier to churn.

Milk for churning accumulated over several days by adding fresh milk to the milk already accumulated.

The churn may hold up to 20 liters and the amount of milk-churned ranges from 4-10 liters. Butter made by agitating the milk until butter grains form.

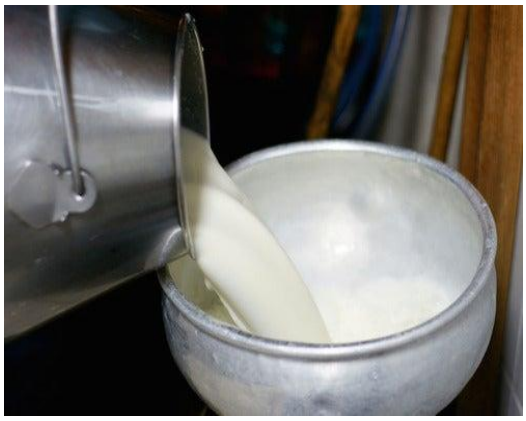
The churner rotated slowly until the fat coalesces into a continuous mass. The butter thus formed taken from the churn and kneaded in cold water.

The milk usually agitated by placing the churn on a mat on the floor and rolling. It can also be agitated, by shaking the churn on the lap or hung from a tripod.

How to Make Home Made Butter

Figure 11 Homemade butter

Step 1: Start with Fresh Cow's Milk, Non Pasteurized or Homogenized, Raw Cow Milk



We use 2 gallons. One to store in fridge and one to clabber.

It takes 3-4 days for fresh milk in the fridge to sour and clabber (old folks call it "going bad"). When you see it looking like it has water on the top and cheese under the water. It is time to church and make butter.

Step 2: Fill Your **Churn**

Put 1 Gallon of clabbered milk in churn and about 1/2 gallon of fresh buttermilk in and start churning.

Step 3: Churn, Churn and Churn Some More... This Takes Time

Swiftly work the ladle in the churn up and down and the butter making process will start in about 30 minutes of vigorous churning.

You will start to notice small droppings of butter around the lid when butter starts making. However, if milks not clabbered enough, churning is prolonged to 1 hour or longer until made.

Step 4: Seeing Butter in Your Churn

Once the butter starts making, after about 45 minutes lift the lid on the churn and see the butter. The first image is when it is clabbered and when it starts making butter, it will golden in color.

Step 5: Take Strainer and Put Butter from Milk in Bowl

Mama always said a glass bowl is best, so I use a glass bowl to remove the butter from the churn. Leave the milk and you can use the fresh buttermilk for cooking (store in fridge).

Step 6: Drain Sour Milk & Wash Butter Thoroughly

Most modern day women miss this step. Wash the sour milk off the butter under cold water for 1-3 minutes. Folding the butter repeatedly under the cold water removed all milk from it.

Step 7: Last Step- Add Salt, Cinnamon, Nutmeg or Your Choice of Butter Spices

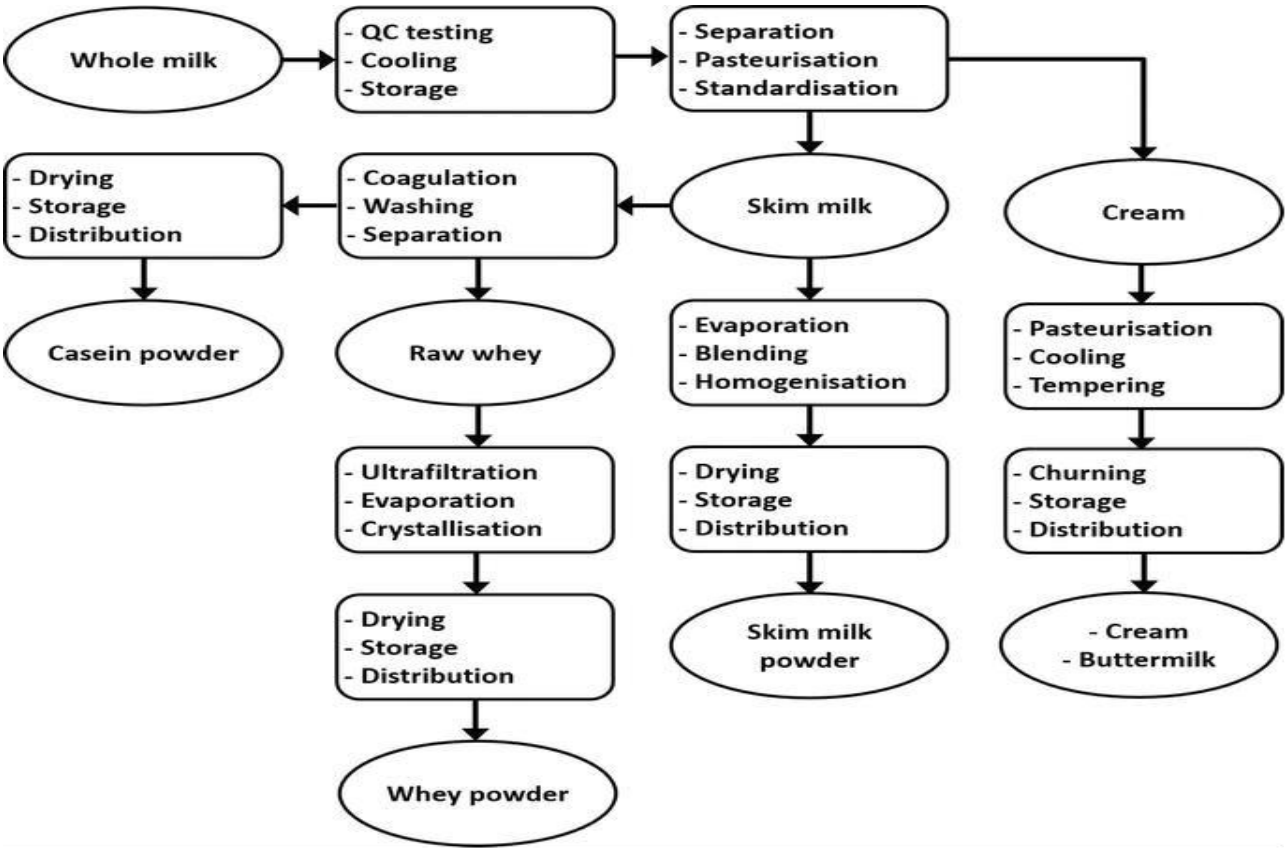
Figure 12 Homemade butter

If you like plain store bought butter's taste, simply add salt to taste and put on a cloth to drain the water from the butter 1-3 minutes. Stir well after any spices have added, butter will be easy to work in this state

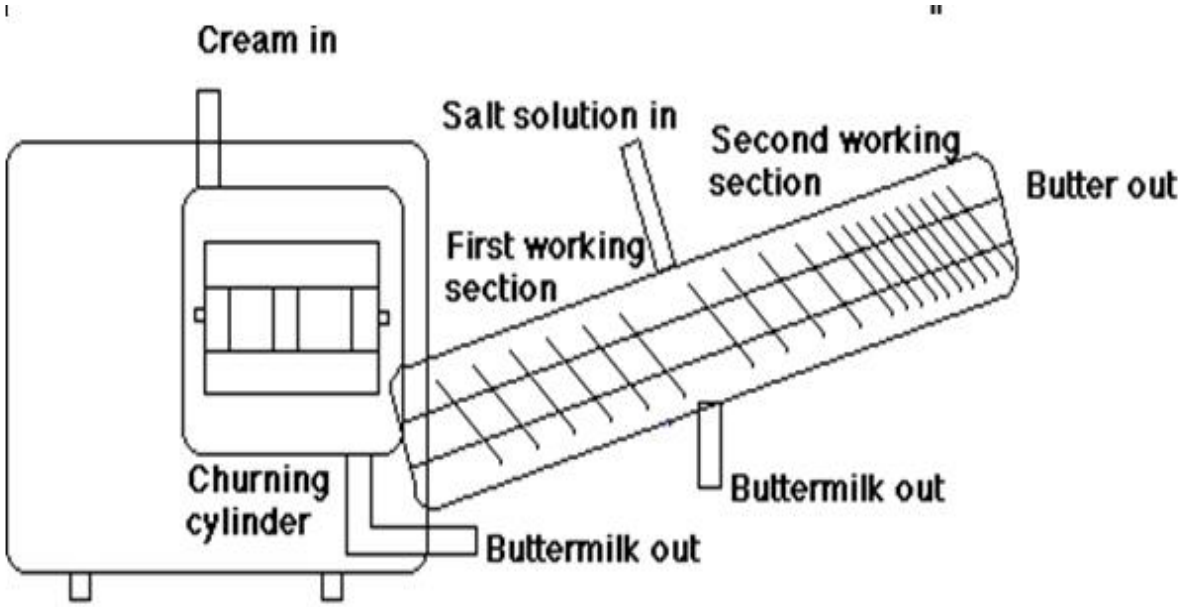
Step 8: Refrigerate While Baking Your Fresh Bread to Eat With Your Butter

Simply put in a bowl and shape any way you desire. Chill for 2-3 hours and this goes perfect with anything you eat butter with. Butter this type butter is pure and 100% organic. No preservatives or nothing. Eating at its finest. May folks still love homemade butter and make it. Mennonite families, people living off the grid and elderly love organic living.

Products and by-products of butter making from sour whole milk



B. Continuous Flotation Churns



Continuous Butter churn

- The Coagulated milk or cream first fed into a churning cylinder fitted with beaters that driven by a variable speed motor.
- Rapid conversion takes place in the cylinder and, when finished, the butter grains and buttermilk pass on to a draining section.
- The first washing of the butter grains sometimes takes place in route with either water or recirculated chilled **buttermilk.**
- The working of the butter commences in the draining section by means of a screw, which also conveys it to the next stage.
- On leaving, the working section the butter passes through a conical channel to remove any remaining buttermilk.
- Immediately afterwards, the butter may give its second washing, this time by two rows of adjustable high-pressure nozzles.

1) The **water pressure** is so high that the ribbon of butter is broken down into grains and consequently any residual milk solids effectively removed

2. Following this stage, **salt** may added through a high-pressure injector.

- The third section in the working cylinder connected to a vacuum pump. Here it is possible to reduce the air content of the butter to the same level as conventionally churned butter.
- In the final or mixing section, the butter passes a series of perforated disks and star wheels. There is also
- An injector for final adjustment of the water content. Once regulated, the water content of the butter deviates less than +/- 0.1%, provided the characteristics of the cream remain the same.
- The finished butter is discharged in a continuous ribbon from the end nozzle of the machine and then into the packaging unit

C. Concentration method

- 30% fat cream pasteurized at 90oC
- Degassed in a vacuum
- Cooled to 45-70oC
- Separated to 82% fat ("plastic" cream)
- The concentrate, still an O/W emulsion, is cooled to 8-13oC
- Fat crystals forming in the tightly packed globules perforate the membranes, cause liquid fat leakage and rapid phase inversion
- Contrast to mayonnaise, also a o/w emulsion at 82% fat but is winterized to prevent crystallization
- Butter from this method contains all membrane material, therefore, more phospholipids
- No butter milk produced
- After phase inversion, the butter worked and salted.

D. Separation

Butter from anhydrous milkfat:

1. Prepare "plastic" cream (>80% fat)
2. Heat with agitation to destabilize emulsion
3. Separate oil from aqueous phase: 82 to 98% butter fat

4. This butter oil is then blended with water, salt and milk solids in an emulsion pump and transferred to a scraped surface heat exchanger for cooling and to initiate crystallization
5. Further worked to develop crystal structure and texture
6. Process similar to margarine manufacture
7. Margarine has advantage of fat composition control to modify physical properties
8. Butter produced by phase separation contains few phospholipids.

Self-Check 1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 2 point)

1. Which one is/ are more efficient for butter making

A. Whole milk **B Cream** C. Fermented milk D. All

2. If the milk holding capacity of churner 20 liters what is the amount of milk can be churned?

A. 4 - liters B. 10-20 liters C. 20liters D. All

Part II Fill the black space

1. List down the approximate: butter composition standard (2%)

No.	Butter content	%
1		
2		
3		
4		

2. What are the operation procedure operator must perform after completing churner or cream separation operation? (2%)

_____

_____

3. Write the types of acidic cream used for butter making! (3%)

_____,_____

_____,_____

4. Write the four types of butter making processes (4%)

_____,_____

_____,_____

. Answer the following question!

Note: Satisfactory rating 8 and 15 points Unsatisfactory below 8 and 15 points

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Operation title: Butter making from fermented milk or Cream

Purpose	To acquire the trainees with butter making **from fermented milk or Cream**
Equipment ,tools and materials	Supplies and equipment needed or useful for Butter making from fermented milk or Cream include these: • Manual local available churner/ an churner • Two gallons (local available for milk storage) • Two bucket one for water holding and another to wash butter) • Petrich dish
Conditions or situations for the operations	• All tools, equipment's and materials should be available on time when required. • Appropriate table, working area/ workshop to churn the milk .
Procedures	1. Start with Fresh Cow's Milk, non-pasteurized or Homogenized, Raw Cow Milk 2. fermented the milk in 3-4 days for fresh milk in the fridge to sour and clabber 3. Fill Your Churn 4. Churn the milk (it may take 30minutes-1hrs or long) 5. Seeing butter in your Churn 6. Take Strainer and Put Butter from Milk in Bowl 7. Drain Sour Milk & Wash Butter Thoroughly 8. Last Step add salt, cinnamon, nutmeg or your choice of butter spices 9. **Refrigerate while baking your fresh bread to eat with your butter**
Precautions	• Care should be taken while churning for the first 10 minutes • Preparing materials, tools and equipment used for milk churning
Quality criteria	• Did personal protective equipment worn while fitting and adjusting cream separator machine • Did trainees proper the trainees proper churn and make butter. • The butter produced composition fat 80% and moisture 16%

Butter making from fermented milk or Cream

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions:

1. You are required to perform any of the following:

   1.1 Butter making from fermented milk or Cream

   1.2 Prepare equipment and material for Butter making from fermented milk or Cream

2. Request your teacher for evaluation and feedback

Operation title: Butter making by Concentration Method

Purpose	To acquire the trainees with butter making **Concentration Method**
Equipment ,tools and materials	Supplies and equipment needed or useful for Butter making Concentration Method include these: • Pasteurization • Cooling material(refrigerator) • Oven dry (vacuum) • Plastic churner • Cream separator • Two bucket one for water holding and another to wash butter) • Petrich dish • Full laboratory equipment
Conditions or situations for the operations	• All tools, equipment's and materials should be available on time when required. • Appropriate table, working area/ workshop to churn the milk.
Procedures	1. 30% fat cream pasteurized at 90oC 2. Degassed in a vacuum 3. Cooled to 45-70oC 4. Separated to 82% fat ("plastic" cream) 5. The concentrate, still an O/W emulsion, is cooled to 8-13oC 6. Fat crystals forming in the tightly packed globules perforate the membranes, cause liquid fat leakage and rapid phase inversio
Precautions	• Care should be taken while churning for the first 10 minutes • Preparing materials, tools and equipment used for milk churning
Quality criteria	• Did personal protective equipment worn while fitting and adjusting cream separator machine • Did trainees proper the trainees proper churn and make butter. • The butter produced composition fat 82% and moisture 16%

: Butter making by Concentration Method

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions:

1. You are required to perform any of the following:

   1.1 Butter making from fermented milk or Cream

   1.2 Prepare equipment and material for Butter making from fermented milk or Cream

2. Request your teacher for evaluation and feedback

Information Sheet 2 Monitoring equipment in operation

2.1 Monitoring equipment in operation

Two criteria used to check the efficiency of converting milk or cream into butter are

A) **Produce**''. Produce or butter ratio is the ratio of milk used to butter obtained from it.

B) **Overrun**, which usually calculated as percent

- Overrun, is the excess of butter made over butterfat used per 100 kg butter or the percentage increase of butter over butterfat.
- An enterprise engaged in butter making must be able to measure the efficiency of the process, i.e. by measuring the yield of **butter** from the **butterfat** purchased.
- First, the theoretical yield of butter has to estimate.
- **Butter** contains an average of **80% butterfat**.
- For every **80 kg of butter-fat** purchased **100 kg of butter** should be produced
- For every **100 kg of butter, fat** purchased **125 kg of butter** should produce.

Overrun the difference between the number of kilograms of butterfat churned and the number of kilograms of butter made

This difference is due to the fact **butter** contains non-fatty constituents such as

- Moisture
- Salt
- Curd
- Small amounts of lactic acid
- Ash in addition to butterfat.

The overrun is financially important to the milk processor and constitutes the margin between the purchase price of butterfat and the sale price of butter.

The dairy unit depends largely on overrun to cover manufacturing costs and to defray expenses incurred in the purchase of milk.

The maximum legitimate **overrun is 25%.** In commercial operation, however, it is not possible to establish the degree of accuracy that assumed in the calculation of theoretical overrun.

The actual overrun shows the difference between the amount of butter churned out and the amount of butterfat bought.

- Overrun is affected by:
  - ✓ Accuracy of weighing milk received
  - ✓ Accuracy of sampling and testing milk for fat
  - ✓ Losses during separation
  - ✓ Efficiency of churning
  - ✓ Percentage of fat in the butter
  - ✓ Amount of salt and water in the butter
  - ✓ Amount of product loss throughout the process.
- The fat content of the whole milk, skim milk and buttermilk should checked daily.
- The moisture content of the butter should checked for each batch.
- The accuracy of weighing scales and other measuring devices should also checked regularly.

2.2.Washing the churn and butter making equipment after use

- The churn and butter making equipment should washed as soon as possible, preferably while the wood is still damp.
- Wash the inside of the churn thoroughly with hot water.
- Invert the churn with the lid on to clean the ventilator; this should pressed a few times with the back of a scrubbing brush to allow water to pass through.
- The ventilator should dismantled occasionally for complete cleansing.
- Remove the rubber band from the lid and scrub the groove.
- Scald the inside of the churn with boiling water, invert and leave to air.
- Dry the outside and treat the steel parts with Vaseline to prevent rusting.
- The rubber band should not placed in boiling water; dipping in warm water is sufficient.

- Place the sieve, scoop and spades on the butter worker or keeler and clean in the same way as the churn.

2.3 Monitoring factor affecting Traditional butter production.

A. Effect of acidity

Fresh milk is difficult to churn churning time is long and recovery of butterfat is poor however, milk containing at least 0.6% lactic acid is easier to churn. Acidity higher than 0.6% does not significantly influence churning time or fat recovery.

B. Effect of temperature

- Sour milk normally churned at between 15 and 26°C, depending on environmental temperature.
- At low temperatures, churning time is long; butter-grain formation can take five hours or longer.
- As churning temperature increases churning time decreases.
- ILCA trials have shown that when churning sour whole milk using the traditional method, fat recovery values of 67% and 44% obtained with churning temperatures of 18°C and 25°C, respectively.
- Controlling the temperature is therefore critical.
- The optimum churning temperature is between 15 and 17°C.

C. Degree of agitation

- Increasing agitation reduces churning time.
- Fitting an agitator to a traditional churn reduces churning time and increases butter yield.
- The percentage of fat recovered as butter increased, with as little as 0.2% fat remaining in the buttermilk.
- The advantage of using the ILCA internal agitator demonstrated when churning sour whole milk at 18°C.
- Using the traditional clay pot a fat recovery of 67% obtained compared to a 76% fat recovery when using the clay pot fitted with the internal wooden agitator.

D. Extent of filling the churn

Churns should filled to between a **third** and **half** their volumetric capacity. Filling to more than half the volumetric capacity increases churning time considerably but does not reduce fat recovery.

Thus, when churning whole milk, the following conditions should be adhered to:

- Milk acidity should be greater than 0.6%
- The temperature should be adjusted to about 18°C
- Internal agitation should be used to reduce churning time and increase fat recovery
- The churn should not filled to more than **half** its **volumetric capacity**.
- Once the fat has been recovered by churning the **buttermilk** contains:
  - ✓ Casein,
  - ✓ Whey proteins,
  - ✓ Milk salts,
  - ✓ Lactic acid,
  - ✓ Lactose,
  - ✓ The unrecovered fat and some fat globule membrane constituents.
- Buttermilk is suitable, and often used, for direct consumption.
- It is also used to inoculate fresh milk to encourage acid development and for cheese making.

Self-Check 2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 2 point)

1. Which one of the following is/ are affect the churner efficiency of converting milk or cream into butter.

A. Churning produce B. Overrun **C.** A and B

2._____ financially important to the milk processor

A. Temperature of the churner C. produced milk

B. Overrun of the churner D. All

Part II Fill the black space

1. List down the non-fatty constituents of **butter**! (4%)

_____,_____

_____,_____

_____,_____

2. List down factors that affect overrun of butter churner (5%)

_____,_____

_____,_____

_____,_____

3. Mention **factor affecting Traditional butter production (4%)**

_____,_____

_____,_____

4. List down the contents of buttermilk! (3%)

_____,_____,_____

_____,_____,_____

. Answer the following question!

Note: Satisfactory rating 9 and 17 points Unsatisfactory below 9 and 17 points

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date_____

Information Sheet 3. Identifying and reporting variation of equipment in operation and maintenance requirement

3.1 Identifying and Reporting variation of equipment in operation and maintenance requirement

3.1.1 Processing Variation

Butter yield and its properties such as

- consistency,
- Moisture content
- Oiling-off affected by numerous interrelated process variables, these include the following. Machine Variables **such as**
- The beater speed
  - ✓ First kneader speed,
  - ✓ Second kneader speed,
  - ✓ Reduced pressure at variation, as summarized here.
- They are an optimum beater speed at which the moisture content is minimum.
  - ✓ Higher speeds result in 'over churning
  - ✓ Speeds below the optimum result in the butter moisture content causing 'under churning.'

3.1.2 Preparing maintenance schedules and procedures

Prepared maintenance schedules and procedures effectively communicated to staff and suppliers to minimize negative impacts on production and costs

The manufacturer's instructions should referred in the development of maintenance and repair programs.

Maintenance and repair programs should specify:

- Where servicing is required;
- The extent of servicing required;
- The nature of the servicing required;
- The frequency of servicing;

Report to supervisor/manager any problems around machines and guards, for example:

- Broken or **missing** guards and devices.

- **Loose** parts, **unusual** noise, leaks, or vibration.
- **Strange** odors, heat, smoke, dust, fumes.
- **Messy** work area and floor, not enough light.
- **Damaged** or **dirty** PPE or PPE that fits badly.
- **Unhealthy** reactions, skin rashes, dizziness, hearing problems

Self-Check .3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part II Fill the black space

1. List down the specification of maintenance and repair programs. (3%)

_____,_____

_____,_____

2. Mentions problems around machines and guards that reported for supervisor or manager! (5%)

_____,_____

_____,_____

_____,_____

3. Mention processing variation that affect milk consistency, Moisture content **and** oiling off (fat %) by processing machine variability! (3%)

_____,_____

_____,_____

. Answer the following question!

Note: Satisfactory rating 6 and 11 points Unsatisfactory below 6 and 11 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 4. Monitoring production stage of process and Meeting confirmed specifications

4.1 Monitoring production stage of process and Meeting confirmed specification

The collected raw milk or from farm in the milk container or truck, having passed the preliminary analytical tests, proceeds to whole milk intake bays and the milk hoses are connected up by the driver.

- The milk pumped into bulk storage tanks called milk silos

4.2 Separation, clarification, and centrifugation

Milk must clarified on reception at dairy farm, to remove particles of dirt such as

- Sand, soil, dust, and precipitated protein, which will protect downstream processing equipment.
- removal of bacteria, spores,
- somatic cells from milk can be achieved with centrifugation and microfiltration techniques
- Somatic cells such as leucocytes are removed, which will reduce the presence of Listeria trapped inside the leucocyte
- Reduction in the microbial load at this point can decrease the burden of biofilms which leads to more efficient work of the HPE
- The clarifier can function with either cold (below 8°C) or hot milk (50–60°C).

4.3 Centrifuges in diary processing plants is hot milk separation.

- Separate the globular milk fat from the serum, the skim milk. This process known as skimming.
- This process generally combined into the pasteurization line and joined with an in-line fat standardization system for both **milk** and **cream**.
- Separate ion normally takes place at 122–140°F (50–60°C)
- The fat content of the cream discharged from the separator controlled to a level of between 20 and 70%.

The terminology for **separation** in the dairy industry includes

- Continuous centrifugal separation of solid particles (Clarifier)
- separation of cream (Separator)

- Separation of bacteria (Bactofuge).

The microbial quality of milk powders is highly significant and it is possible at this early phase of processing to remove 99.9% of the spore-forming bacteria by

- Bacto -fuation or
- Microfiltration preceding heat treatment.

4.4 Pasteurization

Pasteurization originally introduced to control **Mycobacterium bovis**, which causes tuberculosis (TB), which is no longer problematic as cows tested for it.

Standard vat pasteurization is **63°C** (145°F) for **30 min**. However, heat processing can result in the loss of

- Subtle aroma and flavors components,
- Loss of vitamins and natural antioxidants,
- The loss of texture and freshness
- The denaturation of proteins.
- The US Grade A pasteurization milk ordinance (PMO) is managed by the Departments of Health and Human Services and Public Health, and the Food and Drug Administration

4.5 Verifying the pasteurization process

The Pas-Lite test is an internationally accepted method used by dairies and food manufacturers to verify pasteurization for many types of dairy products

4.6 Heat exchanger

- A heat exchanger is used to transfer heat by the **indirect** method

4.7 Batch Butter Churns

Standardization of Cream for butter making

- Adjustment of fat to desired level
- Pearson square method is used
- Dane by adding calculated quantity of skim milk or butter milk
- Desired level of fat in cream for butter making is 33 to 40%

- Standardization to both higher and lower level leads to higher fat loss in buttermilk.

4.8 Churning

- The churn operated at different speeds.
- The range of speed depends on the size and shape of the churn.
- The cream churned at the churning speed (60 - 100 rpm).
- The cream well whipped by the corners, edges and other irregularities in the churn.
- Chilled water sprayed over the churn during churning operation.
- It takes about 35 – 40 minutes for the formation of butter granules of peanut size

A. Rotating churns by Hand

The rotating butter churn introduced in the nineteenth century and gradually from farm butter making it adopted for the factory butter making by the butter industry.

The rotating churns consisted mainly of a barrel rotated on an axis with shelves of various kinds to increase the agitation effect.

Figure 13: Hand rotating churns

B. Batch method using rotating electric churner

- The use of batch churn for butter manufacture is on decreasing trend because of increase in popularity of improved designs of continuous butter making machines
- The energy consumption is about 7-11 kWh per 1000 kg of butter of which about 90% is used in churning and 10% in working.
- The lower values are for the cream with a higher fat content

C. Loading the cream

- Pasteurized cream with 35-40 percent fat properly aged pumped into the churn.
- Cream filled to 40 - 45% of the volume of the churn.
- The cream ripened.

Figure 14: Rotating electric churner

4.9 Buttermilk draining

The churn stopped and buttermilk drained off. Equal quantity of pasteurized wash water added.

Washing

- The churn started again
- The wash water drained off after some time
- Two or three washings are generally given.

4.10 Working

- The wash water drained off and salt added.
- The churn then operated at lower speed (25 - 50 rpm) for working as compared to that at churning. After 3 – 5 min
- Sample taken and moisture adjusted by adding required quantity of water.
- The working carried out still desired body and texture attained.
- Applying vacuum of 5 m of water gauge during working gives close texture by reducing the content of air.

4. 11 washing the butter

- When the desired grain size obtained, the buttermilk drained off and the butter washed several times in the churn.
- Each washing done by adding only as much water as needed to float the butter and then turning the churn a few times.
- The water then drained off. As a general rule two washings are enough but in very hot weather three may be necessary before the water comes away clear
- In the hot season the coldest water available should be used for washing,
- In the cold season water, about 2 -3°C colder than the churning temperature must use.

4.12 Salting, working and packing the butter

- Equipment for working may consist of a butter worker or a tub or keeler.
- Good-quality spatulas are important, and a sieve and scoop facilitate the removal of butter from the churn. This equipment must be clean.
- The butter is spread on the worker which has been previously soaked with water of the same temperature as the washing water
- If salted butter is required, it should salted before working at a rate of 16 g salt/kg or according to taste.
- Salt added to butter most commonly using the dry-salting method in which dry salt is sprinkled evenly over the butter and worked in.
- The salt used should be dry and evenly ground and of the best quality available.

- The butter is then either rolled out 8 to 10 times or ridged with the spatulas to remove excess moisture.
- Adding salt to butter disturbs the equilibrium of the emulsion (the butter). This in turn changes the character of the body and alters its color. Unless the butter is subjected to sufficient working to regain the original equilibrium of the emulsion,
- It will tend to have a coarse, leaky body and uneven color.
- The butter should worked until it seems dry and solid, but it must not worked too much or it will become greasy and streaky.

Butter must adequately worked, if it is to be stored for a long time.

- First, working distributes the salt uniformly in the moisture and this helps inhibit microbial growth.
- Secondly, it distributes the salt solution into many tiny droplets rather than fewer large ones. For a given level of microbial contamination, the microbes will be more isolated in small droplets and will have less of the butter's nutrients available to them for growth.
- Surplus good-quality butter can be stored, but should contain more salt than usual at least 30 g/kg and a low moisture content (14--15%).

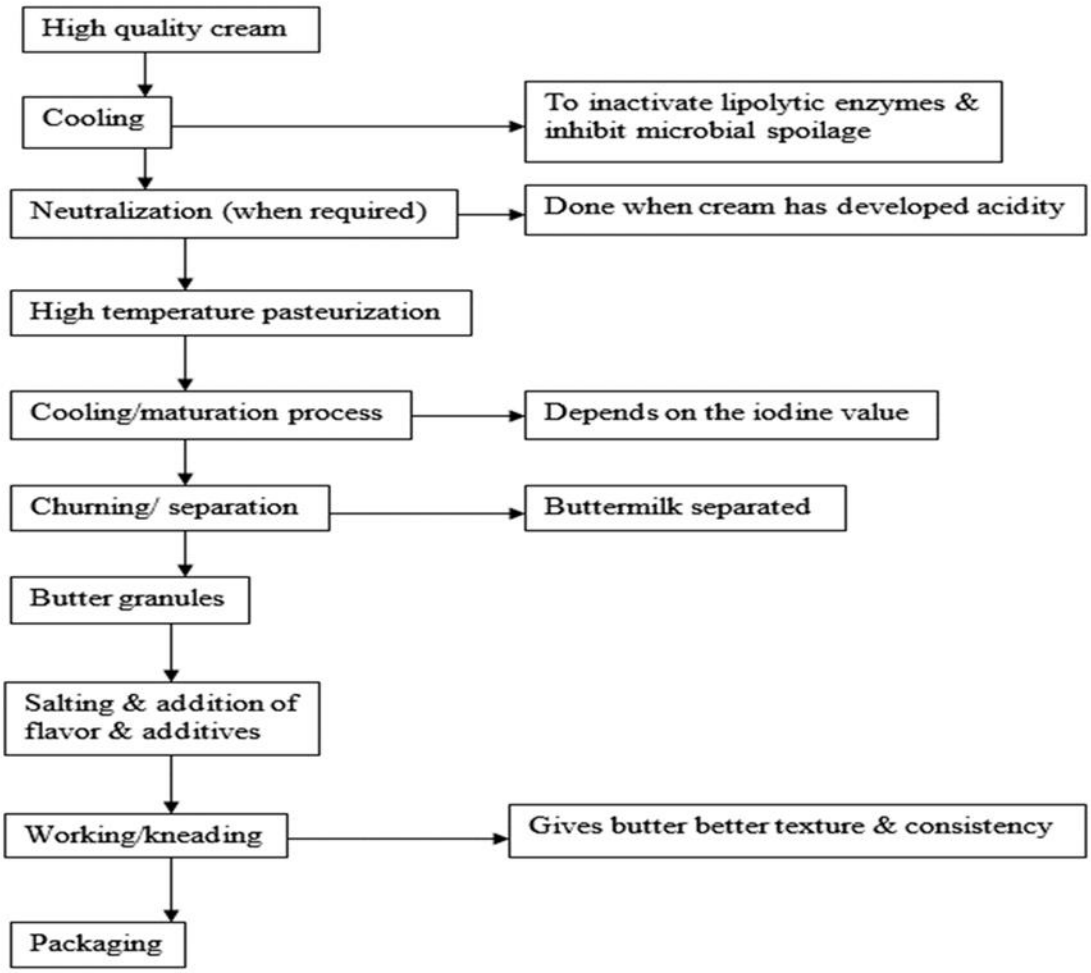
The butter packed in clean containers, such as

- **Seasoned boxes**
- **Glazed crocks**
- Stored in a cold room or in a cold, airy place
- If a box is used, it should line with good-quality polythene.
- The container should filled from one churning.
- The more firmly butter is packed, the better; it may be covered with a layer of salt, but this is not essential.
- The container should be, securely covered with a lid or a sheet of strong paper and stored in a cool, dark place.

4.13 Neutralization

The objective of Neutralization

- To reduce the acidity in cream to appoint (0.14-.0.16) which permits pasteurization without risk of curding
- To produce butter which can be kept well in cold storage
- To avoid excess loss of fat which result from the churning cream i. e excessively sour.
- To prevent undesirable flavors which may result when a cream of high acid which is subjected for pasteurization higher temperature.
- To improve the keeping quality of butter from high acid cream. Salted acid butter develops a fish flavor during commercial storage at 23-to 29C^0



Self-Check 4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I Fill the black space

1._____ bacteria specie that Couse tuberculosis controlled by pasteurization raw milk? (2%)

_____

2. _____ is an internationally accepted method used verify pasteurization for many types of dairy products (2%)

_____

3. What is the standard range of churning speed during churn milk? (2%)

_____

4. List down containers used for butter packed! (3%)

_____,_____

_____,_____

_____,_____

5. What the objective of Neutralization? (3%)

_____

_____

_____

_____

_____

. Answer the following question!

Note: Satisfactory rating 7 and 12 points Unsatisfactory below 7 and 12 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 5. Identifying Rectifying and Reporting Out-of-specification product/process outcome

5.1 Identifying Rectifying and/or Reporting Out-of-specification product/process outcomes

Identification of product/processes outcomes used to check either the products or processes are out of specification or not because every products or processes have their own specifications and have effects on the outcome after processing.

Main objective of Identifying and rectifying out-of-specification product/process outcomes in order to take corrective action in response to out-of-specification results.

5.2 Specification of product/processes

The specifications of cream and butter product have their own specification. Identifying and rectifying the processes and the products outcomes take place throughout the process and take actions when they occur, the processes or products will be out-of-specifications.

If the **moisture content** of butter above the standard and **poor quality butter**

- Churning temperature is high decrease the temperature to10^0C
- Churn speed is high decrease the speed of the 60rpm

if high **fat content** of butte produced

- Churning temperature is decreased adjust the temperature to 10^oC
- Churn speed is decreased adjust the speed of churner 60rpm

If high **yield, weak** and **leaky** butter produced

- Churning temperature is high decrease the temperature 10^0C
- Churn speed is high decrease the speed of the 60rpm

Self-Check 5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I Fill the black space

1 If the **moisture content** of butter above the standard and **poor quality butter, which part of churner require adjustment** (2%)

_____,_____

2. If high **yield, weak** and **leaky** butter produced what measure must take to correct the butter making (2%)

_____

_____

. Answer the following question!

Note: Satisfactory rating 2 and 4 points Unsatisfactory below 2 and 4 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 6 Maintaining work area

6.1 Maintaining work area

6.1 1 Safety Before operation

- Short term training is necessary for the operators
- Become familiar with the safe operation of the equipment, operator must know the machine working principle and operation
- All operators should trained. The owner of the machine is responsible for training the users.
- Check bolts and other loosen parts and tighten it before operation will start.
- When maintaining, inspecting, attaching and detaching parts, park the machine at flat and safe place.
- Use proper tools to maintain the machine and check working area is safe. During Operating
- Only allow responsible person, who are familiar with the instructions, to operate the machine

6.1.2 Maintaining working area. with equipment

- Shutdown the machinery and equipment
- Identify all energy sources and other hazards
- Identify all isolation points
- Isolate all energy sources
- De-energize all stored energies
- Lockout all isolation points
- Tag machinery controls, energy sources and other hazards
- Test by ‘trying’ to reactivate the plant without exposing the tester or others to risk (failure to reactivate ensures that isolation procedures are effective and all stored energies have been dissipated)

Self-Check 6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I Fill the black space

1. List down Safety measure that an operator take before any machine operation**! (4%)**

_____

_____

_____

_____

_____

_____

2. List down tallest 6 point How the operator maintaining work areas with Equipment! (6%)

_____,_____

_____,_____

_____,_____

_____,_____

. Answer the following question!

Note: Satisfactory rating 6 and 10 points Unsatisfactory below 6 and 10 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 7. Conducting Work with workplace environmental guidelines.

7.1 Clarification of work requirement

This describes the interpreting of schedules and plans, as well as a clear understanding of procedures to be undertaken and the targets to meet.

When the requirements of the standards' met, employees understand the role their work

- plays, in maintaining quality output
- Motivated work force supports management in detecting, solving, correcting and preventing problems in the production area.
- Identification of the required resource
- Doing any work related with modern dairy production system we have to allocate the necessary resources which, proper and suitable to undertake the general work activities.

It is usually done within routines methods and procedures where some discretion and judgment is required in the selection of equipment and materials, organization of work, services, and actions to achieve outcomes within time and budgetary constraints should be properly allocated.

The resource, which allocated used to achieve the work. Some of the resources are, materials, tools and equipment, financials, labours, machinery, personal protective equipment, etc, have to be allocated so as to run the work properly

7.2 Develop Health and Safety Program

A good, sound health and safety program is an effective way to manage risks and productivity in your operation.

- Accidents are not only costly in human terms, but they can disrupt the flow of work and halt production.
- There are always hidden costs.
- The actual injury to an employee is only the "tip of the iceberg".A good health and safety program should include the following components:
-

7.3 Written Health and Safety Policy

This simple statement shows your commitment to health and safety for all employees. It only needs to be a few sentences or a short paragraph.

7.4 Written Safety Rules

A set of basic rules for your operation as well as specialized safety rules for specific tasks, equipment or processes need to be developed.

The list should not be long and unmanageable. Rules should be simple and easy to understand and may need to translate into a worker's language.

The rules should be reviewed with all new employees, as well as posted for all employees to see

7.5 Safety Director/coordinator

You need to appoint someone to look after safety as a part of their job. You may also want to have a safety committee or safety representatives from both workers and management. This will keep safety out front all the time.

7.6 Employee Training

- Employees should receive periodic training as necessary to review safety procedures.
- New employees should receive safety training both before and on the job.
- Close -calls or accidents should trigger an immediate review of procedures and safety with employees.

7.7 Workplace Inspection

- System of workplace inspection should be set up to review hazards and practices in the workplace.
- Any time that there is a new process introduced or new machinery installed, an inspection should take place
- Employees should be encouraged to report hazards, close calls or anything out of the ordinary that could lead to

7.8 Injury Emergency Plan

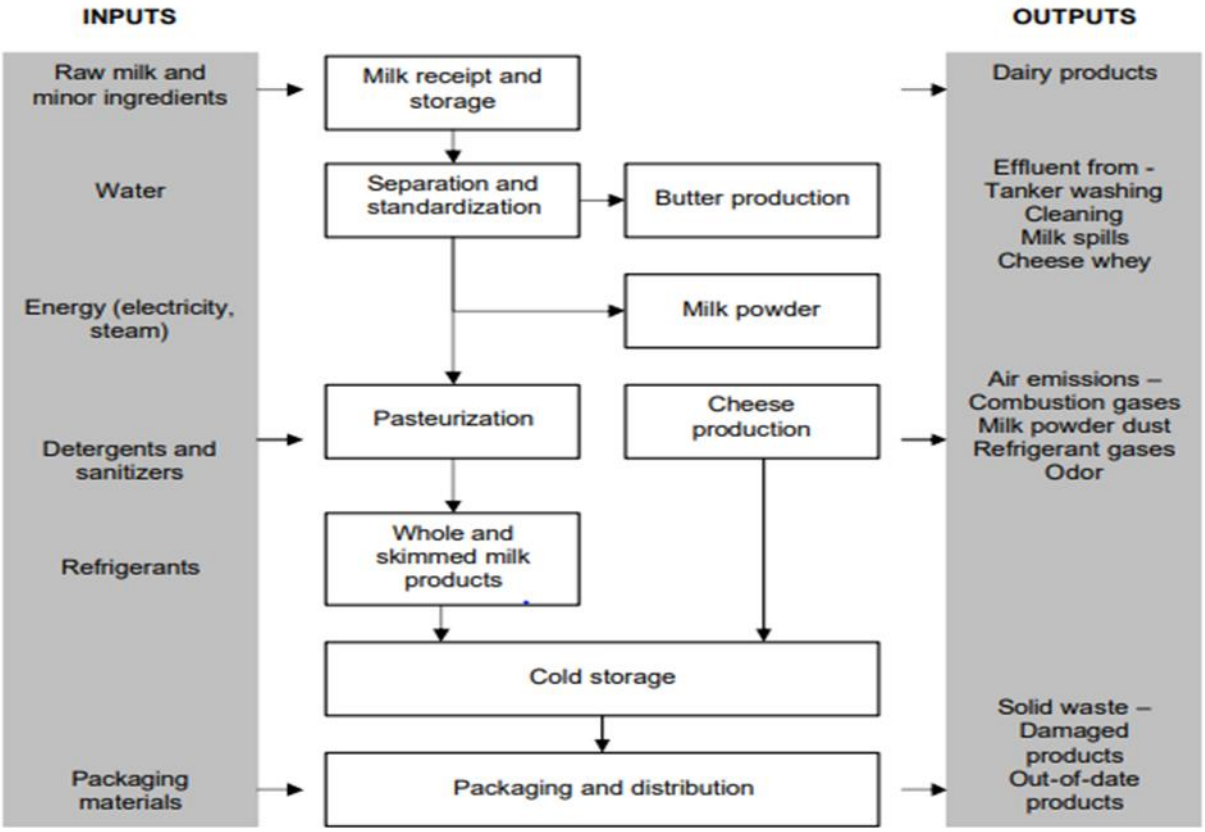
- There should be an emergency plan for any accident, fire, disaster or other unexpected event that may occur
- Employees should know what their responsibilities are during an emergency.
- Plan could include what to do during fires, power failures etc.

Documentation is important

- To keep records of training
- Safety meetings/concerns
- Corrective actions for accident investigations etc. as “Due Diligence”.

7.9 Managing West material from dairy products processing like

- Effluent from
  - ✓ Tanker washing,
  - ✓ Cleaning milk splits
  - ✓ Cheese whey
- Air emission gases
  - ✓ Milk powder dust
  - ✓ Refrigerant gases odor
- Solid Waste
  - ✓ Damaged product
  - ✓ Out of date products


INPUTS
OUTPUTS
Raw milk and minor ingredients
Water
Energy (electricity, steam)
Detergents and sanitizers
Refrigerants
Packaging materials
Milk receipt and storage
Separation and standardization
Butter production
Milk powder
Pasteurization
Cheese production
Whole and skimmed milk products
Cold storage
Packaging and distribution
Dairy products
Effluent from - Tanker washing Cleaning Milk spills Cheese whey
Air emissions – Combustion gases Milk powder dust Refrigerant gases Odor
Solid waste – Damaged products Out-of-date products

Self-Check 7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 2 point)

1. _____is the interpreting of schedules and plans, as well as a clear understanding of procedures to be undertaken and the targets to meet in working place.

A. Develop Health and Safety Program C. Written Health and Safety Policy

B Clarification of work requirement D. Written Safety Rules

2. Which one of the following is/are the air emission gases output in dairy products processing?

A. milk powder dust C. Cheese whey E. A and B

B. Refrigerant gases odor D. Cleaning milk splits

3. Which one of the following is/are the Effluent dairy output in dairy products processing?

A. Tanker washing, B. Cleaning milk splits C. Cheese whey **D. All**

Part II Fill the black space

1. Write the Solid Waste dairy output in dairy products processing (2%)

_____,_____

2. Write the purpose of documenting work place Injury emergency occurred (3%)

_____,_____

_____,_____

. Answer the following question!

Note: Satisfactory rating 6 and 11 points Unsatisfactory below 6 and 11 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 8 Maintaining Workplace information

8.1 Maintain workplace environmental procedures

Every business or organization has work practices that will have an impact on the environment. Some businesses will have a larger impact on the environment than others but all businesses **consume energy**, **raw materials**, and **produce waste but** we all have a role to play in ensuring our business operations are of an environmentally sustainable nature.

8.1.1 Environmentally sustainable is "conserving natural resources by

- Replacing and managing environmental impacts to minimize their adverse effects
- Whether you are volunteering or working in an office environment, in a mobile situation, as a career or working outside, your work practices will have an impact on the environment.
- It is responsibility of everyone in the work place to contribute to the protection of our environment.

8.1.2 Work place procedure and instruction

In working environment, the employees should understand a

- set of work place procedures
- Policies and instructions to address the designed goal in the organization.
- set of policies and procedures in working environment.

A. work place procedure

- Systematically description of how some job function is to be done.
- It is most useful if written in clear language
- Readily available to those who perform that function.

B. Policies and procedures are

- Set of rules and guidelines that are to be followed to achieve goals.
- The policy sets out the overall course of action and what it aims to achieve
- The procedures are the guidelines to be followed to achieve the aims of the policy.

C. Workplace environmental procedures might include such things as:

- Measure for identifying, avoiding or minimizing environmental hazards

- Guidelines for reporting environmental hazards or incidents
- Guidelines about what to do it spills or accidents occur
- Contingency plans to cover emergencies
- Commitment that environmental considerations are included in planning and Operations

D. Workplace environmental procedures are written procedures or work instructions for

- Environmental hazard
- Risk identification
- Avoiding or minimizing environmental risks
- Improving environmental performance
- Waste minimization and segregation
- Environmental monitoring,
- Signs and labels (e.g. chemical labels),
- Emergency procedures,
- Hazard and incident recording and reporting procedures
- Environmental data recording and reporting procedures where applicable.
- Verbal instructions from persons with responsibility related to environmental work practices are also included in this definition

F. Preparing procedures

To write effective procedures you should convert accepted policies from your organization in to a series of coordinated activities and tasks which:

- Set out clearly what people need to do
- Assist in identifying competencies which individuals require
- Form the basis for measuring performance of the individual , group or organization

G. Procedures should cover:

- Responsibilities
- Task instructions
- Timing
- Results

H. Relevant legislation codes and national standards

That a person will acknowledge that environmental impacts, hazards and risks exist, and that they have a responsibility to work in a manner, which will minimize the impact on the environment within the guidelines established by the workplace.

All dairy production facilities must comply with applicable planning and environmental protection legislation for their state.

It is important to identify the legal requirements for the processing and to confirm compliance with these obligations. Arguably, the most important legal constraints for any dairy production facility are the consents, approvals or licenses to operate.

Impact of workplace practices on environment

There are seven recognized environmental hazards in the workplace. These hazards do have their own impacts on the environment.

- Waste
- Energy
- Water
- Erosion and sediment
- Air and atmospheric contaminates
- Hazardous substances
- Contaminated land

If this hazard cannot controlled according to the policies and procedures of the farm or organization, they do have their own influence to the environment.

Occupational health and safety hazards for dairy processing operations include the following:

- Physical hazards
- Biological hazards
- Chemical hazards
- Exposure to heat
- cold, and radiation

Self-Check 8	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 2 point)

1. _____ is “conserving natural resources by Replacing and managing environmental impacts to minimize their adverse effects

A. Environmentally sustainable C. Workplace environmental procedures

B. Work place procedure and instruction D. Policies and procedures

Part II Fill the black space

1. Write the seven recognized environmental hazards in the workplace. Waste (7%)

_____,_____,_____,_____

_____,_____,_____

2. What the Occupational health and safety hazards in dairy product processing operation (5%)

_____,_____

_____,_____

. Answer the following question!

Note: Satisfactory rating 8 and 14 points **Unsatisfactory below 8 and 14 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

LG #38	LO #2 LO3. Shut down the butter churning process

Instruction sheet

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

- Identifying appropriate shutdown procedure
- Shutting down procedures of the process
- Identifying and reporting maintenance requirements

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

- Identifying appropriate shutdown procedure
- Shutting down procedures of the process
- Identifying and reporting maintenance requirements

Learning Instructions:

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

Information Sheet1. Identifying appropriate shutdown procedure

3.1 Appropriate shutdown procedure for Dairy equipment

- Never use any machine you have not trained to use.
- Pull plug or throw switch to off position before cleaning or adjusting any machine.
- Keep fingers, hands, spoons
- Away from moving parts.
- Wait until machine stops before moving cream or butter (any milk product).
- Check all switches to see that they are off before plugging into the outlet.

Particular care must take when, **cleaning** the slicing machine.

- **First, pull the plug.**
- Turn the gauge to zero in order to cover the edge of the blade
- Do not touch the edge of the circulated/ revolving body of machine
- Clean the internal from the center out.
- Clean the inside edge of the machine with a stick that has a cloth wrapped around one end.
- Do not start machine until the bowl locked in place and the attachments are securely fixed

When using electric cream separator and Churner

- Turn off motor before you scrape down the sides of the bowl.
- Use a wooden or plastic plunger rather than your hands or spoons to push Cream or Butter into cream or Butter collection center (material)
- Keep your hands to the front of the revolving bowl when operating electric cream separator or churner. This is one of the most **dangerous** place of equipment in the commercial milk processing.
- Never start a machine until you are sure all parts are in their proper places. If a machine that operates with gears, check the gear position.
- You must be aware of the lockout procedures that are to be followed before repairing or cleaning any machine
- Lock-out procedures must be clearly posted by management near each machine

- When using electrical power equipment, always follow the manufacturer's instructions and recommendations.
- Do not wear **rings**, a **wristwatch**, or a **tie** when operating electrical power equipment.
- Never talk while operating any machine

Self-Check 1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part II Fill the black space

1. Write the down appropriate shutdown procedure for Dairy equipment (5%)

_____,_____

_____,_____

_____,_____

2. Explain the producers taken when **cleaning** the slicing machine (4%)

_____,_____

_____,_____

_____,_____

. Answer the following question!

Note: Satisfactory rating 5 and 9 points Unsatisfactory below 5 and 9 points

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

Score = _____
Rating: _____

Answer Sheet

Name: _____ Date: _____

Information Sheet-2. Shutting down procedures of the process

2.1 Shutting down procedures of the process

1. Shut off electric **cream separator** and **churner** at stop/start switch.
2. Shut off at/ disconnect electric cable if possible
3. Apply lock to disconnect. Put key in pocket, do not leave key in lock!
4. Attempt to start machine, reset or return switch to "**off**" position.
5. Complete work on dairy product processing machine
6. Ensure electric machine or equipment are clear of loose pieces, tools, etc
7. Remove lock. If it is operated by lock key
8. Restart and run up to operating speed.

The shutting down procedure of electric Cream separator and churner machine

- Turn the machine on and allow about 1 full minute to let the machine get up to the proper speed
- Turn the tap to the "ON" position.
- Observe the process until all of the milk has passed out of the milk tank
- Let the cream and milk drip for another moment , then remove the containers
- Put another container in place to catch the rinse water then immediately pour about 4 quarters (3lits) of hot water (150^0F) in to milk tank. This will clean the cream from the disks.
- When the water has run out of the milk tank, turn off the machine and allow the machine to come a complete stop.

2.2 Cleaning of milk Contact parts of cream separator

- The bottom Wrench should bolted to your worktable for ease of disassembly of the bowl.
- Disassembly the bowl
- Wash all parts in soap and warm ware until thorough clean.
- Rinse well and wipe dry
- All another milk contact parts except the body , should be washed the same way in soap and warm water including
  - ✓ Milk tank
  - ✓ Floater
  - ✓ The two spouts
- Rinse well and wipe dry.
- This dismantling and washing procedure must followed before first use and after every use.

Self-Check 2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part II Fill the black space

1. List down at least five procedures of dairy product processing machine shutting down equipment (5%)

_____,_____

_____,_____

_____,_____

_____,_____

2. Write steps cream separator must follow to clean the machine (5%)

_____,_____

_____,_____

_____,_____

_____,_____

. Answer the following question!

Note: Satisfactory rating 5 and 9 points Unsatisfactory below 5 and 9 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 3. Identifying and reporting maintenance requirements

3.1 Identifying and reporting maintenance requirements

Maintenance is the upkeep of plant and machinery in proper working condition at all times

Maintenance plan in dairy product processing includes

- maintenance activities and schedules
- maintenance costs and budget details
- Staff resource and supply requirements
- staff roles and responsibilities
- contingency plan for staff and supply problems
- reporting requirements
- hazard and risk control measures
- OHS procedures, personal protective clothing and equipment requirements
- environmental impact control measures

Enterprise requirements include

- Standard Operating Procedures (SOP),
- Industry standards and production schedules,
- Material Safety Data Sheets (MSDS)
- Legislative and licensing requirements
- Work notes, product labels and manufacturers specifications,
- Operator's manuals, enterprise policies and procedures (including waste disposal, recycling and
- re-use guideline, and OHS procedures

3.2 Maintenance of basic dairy products processing equipment

1. Milk cans

Great care should be observed in the handling of milk cans i.e. that they are not dented or damaged more than necessary

During cleaning of cans, the cleaning solution should kept at the proper strength as alkali or acid cleaner of high concentration remove the tin and allow rusting.

Thorough drying of cans will increase their life span and improve on milk quality handled.

2. Milk cooling equipment.

Various types of refrigeration equipment ranging from surface coolers, immersion coolers, ice-bank and direct expansion refrigeration systems are in use throughout the dairy industry.

Whereas it is beyond the scope of this guide to go into detailed description of maintenance systems of each type of cooling system, it suffices to mention here that manufacturer instructions on service ice and scheduled repairs should followed very strictly. Special attention should paid to lubrication of compressors and detection and timely repair of refrigerant gas leakages.

Where brine used as a coolant, its corrosiveness to dairy equipment should also receive particular precautions during its circulation and handling. In view of the importance of milk cooling vats in dairy industry from the producer cooperatives to the processing factories here we produced a summary of faultfinding procure for direct expansion refrigeration vat:

ITEM	PROBLEM	CHECKLIST
Vat milk temperature	Above 4-5C	Check if condensing units are running. Check time since milk was put in vat, and (if recorded), the temperature of the milk in the vat just as it had been put in. Check quantity of milk in vat. The vat system should cool 10,000 litres of milk at rate of 1.8C per hour or 5,000 litres of milk at 3.6C per hour. If time taken is excessive, call maintenance firm/engineer. If condensing units are not running, check control switches on panel. If these are on, check power supply, including low voltage control. If power is OK, check vat control unit. If no action, check fuses, if still no action, call maintenance firm/engineer.
Vat milk	Below 4C	Check/adjust settings on vat control unit.
Agitator	Not running when it should	Check power supply. Check settings of vat controller and control switch on panel. Check fuses. If still no action-call maintenance firm/engineer.
Milk pump	Not running when it should Excess noise/heat Milk leakage	Check power supply. Check starter re-set button on panel. Check fuses. If still no action-call maintenance firm/engineer Call maintenance firm/engineer Check cover "O" ring; tighten nuts or replace "O" ring. If leaking from adaptor housing, call maintenance firm/engineer to replace carbon seal unit.
Power	Plant not running	Check phase indicator lights (or vol meters if fitted) on panel. Check indicator light for low voltage control. If power is on and low voltage trip-out light is showing, wait for voltage to rise (call PLN or get generator checked if necessary). If power is on and low voltage tri-out is not showing, wait 5 minutes. If no plant will run after 5 minutes, call maintenance firm/engineer.
All plant	Frequent resetting required	Call maintenance firm.

3.3 Milk separator maintenance

- The gears must well lubricated; Follow manufacturer's instructions.

- The level of the lubricant must kept constant; observe the oil level through the sight glass.
- The bowl must carefully balance.
- The bowl should cleaned thoroughly immediately after use to ensure proper functioning of the separator and for hygiene.

3.4 Butter churn maintenance

- The churn and butter making equipment should washed as soon as possible, preferably while the wood is still damp in the case of wooden churns.
- Wash the inside of the churn thoroughly with hot water. Invert the churn with the lid on in order to clean the ventilator; this should be pressed a few times with the back of a scrubbing brush to allow water to pass though (NB ventilator should be dismantled occasionally for complete cleansing).
- Remove the rubber seal from the lid and scrub the groove. Scald the inside of the churn with boiling water or steam. Invert and leave to dry.
- Dry the outside and treat metal parts with food grade grease or Vaseline to prevent rusting
- The rubber seal should place in boiling water or dipping in warm water with disinfectant is enough.

3.5 Milk pumps

Generally follow manufacturer's instructions and lubrication procedures outlined above

PROBLEM	POSSIBLE CAUSES
No. Liquid delivered	Delivery head too high. Suction lift too high Pump not primed - not filled with liquid.
Not enough liquid delivered	Suction line leaks air. Shaft seal leaks sir. Delivery head too high Suction lift too high Wrong direction of rat. Suction line smaller than pump inlet Air in liquid. Impeller channels too small.
Pump works for a while and then the flow rate is reduced	Suction line leaks air. Air in liquid. Suction lift too high. Impeller channels clogged.
Motor overloaded and becomes too warm	Head too low, pump flow rate becomes too high, throttle outlet or reduce impeller diameter. Density of liquid too high. Viscosity of liquid too high. Mechanical defects. Impeller may be rubbing against pump casing.
Pump vibrates	Cavitation Head much too low. Impeller or shaft unbalanced (shaft bent) Motor pump not properly aligned. Impeller channel clogged.

3.6 Plate Heat Exchanger

Generally follow manufacturer’s instructions and preventive maintenance

Programmed

Pay particular attention to possibilities of under-pasteurization, recontamination of pasteurized milk due to air leakages into the system, and milk leakages. Have in place manual product temperature indicating thermometers in addition to automatic monitors. Pay particular attention to the functioning of the flow diversion valve.

3.7 Hot Water/Steam boilers

There are two types of boilers; the Fire tube boilers and the water tube type. Whichever type of boiler is used, the proper functioning of the following controls and accessories are essential for efficiency and safety.

- Boiler waver feed pump
- Oil fuel filter
- Safety valves
- Blow down valves
- Water level gauges
- Low water alarms and cut-outs
- Steam pressure gauges

These have to be regularly checking and maintaining for proper economical running of the equipment.

Smaller dairies now utilize hot water generators using electric coils. Whey dealing with steam boilers or hot water generators generally follow manufacturers' instructions and preventive maintenance programmer for dairy equipment (see section 2.2).

3.8 Air Compressors

Air compressors needed in the dairy plant for operation of pneumatic valves and presses. They consist of a compressor pump, motor, air receiver and electrical controls. Generally, follow manufacturer’s instructions and preventive maintenance programmed (see section 2.2). Pay particular attention to the functioning of the compressor and motor which the heart of the machine.

3.9 Setting up of Machinery

In setting machinery, the equipment should be located, if possible in a lighted dry place with plenty of room to work around it for cleaning and repairs. The arrangement should be that the minimum amount of sanitary piping used, consistent with efficient operation. Related equipment may be grouped together to facilitate supervision. Straight-line flow of product is usually desirable. If possible, allow space for unit machine to added later when the business grows.

Machines especially the heavy ones, are set directly on the floor or on concrete base and grated in thoroughly with a rich cement mixture (1 part cement and 2 1/2 parts sand) and sufficient water.

For improved sanitation, use is made of the ball foot mounting with equipment such as tanks, freezers, fillers etc, on a pipe legs 6-12 inches long having a round foot. Where machinery bolted down, it is customary to see bolts in the concrete

Self-Check 3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part II Fill the black space

1. Mention dairy product processing equipment that need scheduled maintenance (5%)

_____,_____,_____
_____,_____,_____
_____,_____,_____

2. Mention the main enterprise requirement procedures applied in the work place (5%).

_____,_____
_____,_____
_____,_____

. Answer the following question!

Note: Satisfactory rating 6 and 10 points Unsatisfactory below 6 and 10 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

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The trainers who developed the TTLM

No	Name	Qual.	Educational background	Region	E-mail
1	Hirpha Ketema	A	Animal Production	Oromia	hirphaketema2@gmail.com
3	Abera Shiferaw	B	Animal production and health	Oromia	aberashiferaw2014@gmail.com
2	Tarekegn cheo	B	Agricultural and process Engineering	Sidama	tarekegncheo155@gmail.com
4	Tesfaye Asrat	B	Animal Science	Amhara	tesfaye99love@gmail.com
5	Mamo Abdi	A	Environmental science	Oromia	mamoab57@gmail.com

Answer Key for self-check

Module Title: Operating a Butter Churning and Oil Production Process

LO #1-Prepare the butter churning and butter oil equipment and process for operation

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Self-Check 2	Written Test

I. Choose the best answer (each 1point)

1. C. **Butter**
2. .B) **19th** C.21th D None
3. D. **Al**l
4. **D. All**.
5. **D. Butter oil.**
6. **D. pasteurization of cream**
7. **D. All**

Part II fill the blank space

1. List down the most common butter **packing** containers and storage system!(5%)

- seasoned boxes or glazed crocks
- stored in a cold room or in a cold, airy place.
- If a box is used, it should be lined with good-quality polythene
- The container should be filled to capacity from one churning.
- The more firmly butter is packed, the better; it may be covered with a layer of salt, but this is not essential.
- The container should securely covered with a lid or a sheet of strong paper and stored in a cool, dark place.

2. Mention the most milk product in Africa agricultural systems! (3%)

- Butter
- Ghee
- Chees

Self-Check 2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Fill the blank space

1. List down the producer of preparing churner for butter making**! (4%)**
   - Rinsing with cold water
   - Scrubbing with salt
   - Rinsing again with cold water.
   - Alternatively, it can be scalded with water at 80°C.

2. List down the producer of preparing new churner for butter making**! (4%)**
   - washed with tepid water
   - scrubbed with salt
   - **Washed** with hot water until the water comes away clear.
   - A hot solution of salt should allowed standing in the churn for about ten minutes.
   - After rinsing again with hot water the churn should left to air for at least one day before being, used

3. Mention the parts of churner require maintenance after operation! (4%)
   - Driving gear should filled with lubricating oil and every alternate year replace it.
   - While the churner is running, never change the speed of churner
   - Solid foundation is necessary.
   - Gaskets to be maintained leak proof.
   - Proper roughness inside of the churner should maintained.
   - Proper cleaning of the churner before and after the operation completed

Self-Check 3	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 2 point)

1. **D) Churner**
2. **C. A and B**
3. **C. one-half of churner capacity**
4. B.10 minutes
5. C. **Churner temperature gauge**

Self-Check -4	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I fill the blank space

1. List down the most common procedures milk preparation and operation in cream separation process! (5%)

- Milk must be strained to remove any dirt or particle
- Milk must not be cold, homogenized or Sour
- For best results, separate milk right out of the cow. If that is not possible rewarm the milk to approximate cow body temperature 100^0F(38^0C)
- It is very important that the milk is warm and stays warn though out the separating process
- Pre warm the separator as follow
- Place the containers under the spout to catch the water
- Open the tap and turn the machine on. Therefore, the hot water flows through the separator, and warms all the milk contact parts and close the tap.

Self-Check 5	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 2 point)

1. **C. Separator**
2. A. **Homogenize**r
3. **B. Pasteurizer**
4. **B. Cream and skimmed milk**

Self-Check 6	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part II Fill the black space

1. Mention the three key of objective of pre-start inspection! (3%)

- . First that the equipment inspected.
- Second, that identified faults or hazards reported and rectified.

- Third, that unsafe equipment taken out of service until it is safe to use.

2. What are the operation procedure the operator must after perform after completing churner or cream separator operation? (2%)

- Remove remaining objects and wash in Agitating part, Body part and Drain Cap part.
- Fasten the loosen bolts and nuts after operation

3. What are sensitive parts of Churner or cream separator machine first inspect to start (4%) the operation?

- Bolts
- Drain
- Cap tightness
- Pins.

4. What types of problems occurred, if Poor machinery and equipment installation faced in work area? (3%)

- blamed of many operating
- health and safety problem
- quality assurance problems in processing unit

LO #2- Operate and monitor the butter churning and the butter oil process operation	
Self-Check 1	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 2 point)

1. **B Cream**

2. A. 4-10 liters

Part II Fill the black space

1. List down the approximate standard: butter composition (2%)

No.	Butter content	%
1	Fat	80%
2	Moisture	16%
3	Salt	2%
4	Milk SNF	2%
	Total	100%

2. What are the operation procedure operator must perform after completing churner or cream separation operation? (2%)

- Remove remaining objects and wash in Agitating part, Body part and Drain Cap part.
- Fasten the loosen bolts and nuts after operation

3. Write the types of acidic cream used for butter making! (3%)

1 Sweet cream butter----- No-acidified cream=PH of 6 ≥.4

1.2 Mildly acidified butter----Paircilly acidified sweet cream = PH 52.2 to 6.3

1.3 Sour cream butter---Ripened cream >0.2% acidity PH ≤5.1

4. Write the four types of butter making processes (4%)

E. Traditional batch churning from 25- 35% mf. cream;
F. Continuous flotation churning from 30-50% mf. cream;
G. The concentration process whereby "plastic" cream at 82% mf
H. The anhydrous milkfat process whereby water, SNF, and salt emulsified into butter oil in a process very similar to margarine manufacture.

Self-Check 2	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 2 point)

1. **C.** A and B
2. **B. Overrun of the churner**

Part II Fill the black space

1. List down the non-fatty constituents of **butter**! (4%)

- Moisture
- Salt
- Curd
- Small amounts of lactic acid
- Ash in addition to butterfat

2. List down factors that affect overrun of butter churner (5%)

- Accuracy of weighing milk received
- Accuracy of sampling and testing milk for fat

- Losses during separation
- Efficiency of churning
- Percentage of fat in the butter
- Amount of salt an d water in the butter
- Amount of product loss throughout the process.

3. Mention **factor affecting Traditional butter production (4%)**

- **Effect of acidity**
- **Effect of temperature**
- **Degree of agitation**
- **Extent of filling the churn**

4. List down the contents of buttermilk! (3%)

- ✓ Casein,
- ✓ Whey proteins,
- ✓ Milk salts,
- ✓ Lactic acid,
- ✓ Lactose,
- ✓ The unrecovered fat and some fat globule membrane constituents

Self-Check 3	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part II Fill the black space

1. List down the specification of maintenance and repair programs. (3%)

- Where servicing is required;
- The extent of servicing required;
- The nature of the servicing required;

2. Mentions problems around machines and guards that reported for supervisor or manager! (5%)

- Broken or **missing** guards and devices.
- **Loose** parts, **unusual** noise, leaks, or vibration.

- **Strange** odors, heat, smoke, dust, fumes.
- **Messy** work area and floor, not enough light.
- **Damaged** or **dirty** PPE or PPE that fits badly.
- **Unhealthy** reactions, skin rashes, dizziness, hearing problems

3. Mention processing variation that affect milk consistency, Moisture content **and** oiling off (fat %) by processing machine variability! (3%)

- First kneader speed,
- Second kneader speed,
- Reduced pressure

Self-Check 4	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part II Fill the black space

1. **Mycobacterium bovis**
2. Pas-Lite test
3. 60 - 100 rpm
4. List down containers used for butter packed!

- **Seasoned boxes**
- **Glazed crocks**
- Stored in a cold room or in a cold, airy place
- If a box is used, it should line with good-quality polythene.
- The container should filled from one churning.

5. What the objective of Neutralization?

- To reduce the acidity in cream to appoint (0.14-.0.16) which permits pasteurization without risk of curding
- To produce butter which can be kept well in cold storage
- To avoid excess loss of fat which result from the churning cream i. e excessively sour.
- To prevent undesirable flavors which may result when a cream of high acid which is subjected for pasteurization higher temperature.

- To improve the keeping quality of butter from high acid cream. Salted acid butter develops a fish flavor during commercial storage at 23-to

Self-Check 5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I Fill the black space

1. If the moisture content of butter above the standard and poor quality butter, which part of churner require adjustment (2%)

- **Temperature Gauge**
- **Speed of churner/ overrun**

2. If high **yield, weak** and **leaky** butter produced what measure must take to correct the butter making (2%)

- Churning temperature is high decrease the temperature 10^0C
- Churn speed is high decrease the speed of the 60rpm

Self-Check 6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I Fill the black space

1. List down Safety measure that an operator take before any machine operation**! (4%)**

- Short term training is necessary for the operators
- Become familiar with the safe operation of the equipment, operator must know the machine working principle and operation
- All operators should trained. The owner of the machine is responsible for training the users.
- Check bolts and other loosen parts and tighten it before operation will start.
- When maintaining, inspecting, attaching and detaching parts, park the machine at flat and safe place.
- Use proper tools to maintain the machine and check working area is safe. During Operating

- Only allow responsible person, who are familiar with the instructions, to operate the machine

2. List down tallest 6 point How the operator maintaining work areas with Equipment! (6%)

- Shutdown the machinery and equipment
- Identify all energy sources and other hazards
- Identify all isolation points
- Isolate all energy sources
- De-energize all stored energies
- Lockout all isolation points
- Tag machinery controls, energy sources and other hazards

Self-Check 7	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 2 point)

1. **B Clarification of work requirement**
2. **E. A and B**
3. **D. All**

Part II Fill the black space

1. Write the Solid Waste dairy output in dairy products processing (2%)
   - ✓ Damaged product
   - ✓ Out of date products
2. Write the purpose of documenting work place Injury emergency occurred (3%)
   - To keep records of training
   - Safety meetings/concerns
   - Corrective actions for accident investigations etc. as “Due Diligence”.

Self-Check 8	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the best answer (each 2 point)

1. **A. Environmentally sustainable**

Part II Fill the black space

1. Write the seven recognized environmental hazards in the workplace. Waste (7%)

- Waste
- Energy
- Water
- Erosion and sediment
- Air and atmospheric contaminates
- Hazardous substances
- Contaminated land

2. What the Occupational health and safety hazards in dairy product processing operation (5%)

- Physical hazards
- Biological hazards
- Chemical hazards
- Exposure to heat
- cold, and radiatio

LO #2 LO3. Shut down the butter churning process

Self-Check 1	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part II Fill the black space

1. Write the down appropriate shutdown procedure for Dairy equipment (5%)

- Never use any machine you have not trained to use.
- Pull plug or throw switch to off position before cleaning or adjusting any machine.
- Keep fingers, hands, spoons
- Away from moving parts.
- Wait until machine stops before moving cream or butter (any milk product).
- Check all switches to see that they are off before plugging into the outlet.

2. Explain the producers taken when **cleaning** the slicing machine (4%)

- **First, pull the plug.**
- Turn the gauge to zero in order to cover the edge of the blade
- Do not touch the edge of the circulated/ revolving body of machine
- Clean the internal from the center out.
- Clean the inside edge of the machine with a stick that has a cloth wrapped around one end.

Self-Check 2	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part II Fill the black space

1. List down at least five procedures of dairy product processing machine shutting down equipment (5%)

- Shut off electric **cream separator** and **churner** at stop/start switch.
- Shut off at/ disconnect electric cable if possible
- Apply lock to disconnect. Put key in pocket, do not leave key in lock!
- Attempt to start machine, reset or return switch to "**off**" position.
- Complete work on dairy product processing machine
- Ensure electric machine or equipment are clear of loose pieces, tools, etc
- Remove lock. If it is operated by lock key
- Restart and run up to operating speed.

2. Write steps cream separator must follow to clean the machine (5%)

- The bottom Wrench should bolted to your worktable for ease of disassembly of the bowl.
- Disassembly the bowl
- Wash all parts in soap and warm ware until thorough clean.
- Rinse well and wipe dry
- All another milk contact parts except the body , should be washed the same way in soap and warm water including
  - ✓ Milk tank
  - ✓ Floater
  - ✓
  - ✓ The two spouts

Self-Check 3	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part II Fill the black space

1. Mention dairy product processing equipment that need scheduled maintenance (5%)
Milk cans, Milk cooling equipment, Milk separator, Butter churn, Milk pump, Plate Heat Exchanger, Hot Water/Steam boilers, Air Compressors, Setting up of Machinery

2. Mention the main enterprise requirement procedures applied in the work place (5%).

- Standard Operating Procedures (SOP),
- Industry standards and production schedules,
- Material Safety Data Sheets (MSDS)
- Legislative and licensing requirements
- Work notes, product labels and manufacturers specifications,
- Operator's manuals, enterprise policies and procedures (including waste disposal, recycling and
- re-use guideline, and OHS procedures