DAIRY PRODUCTION

Level III

Learning guide 57

Unit of Competence: - Operate specialized dairy Machinery and equipments

Module Title: - Operating specialized dairy Machinery and equipments

LG Code: AGR DRP3 M15 LO1-LG-57

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LO1:- Select and prepare specialized Dairy machinery and equipment

For use

Instruction Sheet	Learning Guide 57

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

- Selecting and preparing specialized machinery and equipment is to job requirements and confirming against work plan.
- Completing routine pre-operational checks of specialized machinery and equipment.
- Identifying, assessing occupational Health and Safety (OHS) hazards and implementing risk controls

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Select and prepare specialized machinery and equipment is to job requirements and confirm against work plan.
- complete routine pre-operational checks of specialized machinery and equipment
- Identify, assess Occupational Health and Safety (OHS) hazards and implement risk controls.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 1 to 7.
3. Read the information written in the “Information Sheet (**1, 2 and 3)** in page **3, 35 and 39** respectively.
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the **“Self-check 1, Self-check 2 and Self-check 3”** in page**, 35, 38 and 45** respectively.
6. If you earned a satisfactory evaluation proceed to “Operation Sheet 1, 2 and 3 in page 46, 47 and 49 in page respectively.

7. Do the “LAP test” in page 49 (if you are ready). Request your teacher to evaluate your performance and outputs.

Information Sheet-1	**Selecting and preparing specialized machinery and equipment to job requirements and confirming against work plan.**

Introduction

Milk processing equipment is the main part of any dairy plant. It performs various operations of milk like milk storing, separating, pasteurizing, homogenizing and much more. The milk equipments play the main role in dairy plants to produce milk products like cheese, butter, cream, yogurt and much more.

Definition of machine implements, machines and machinery

A machine is a device with a specific mechanism in it to perform a specific task or tasks with certain mechanical advantage. Or simply it is a device that gives mechanical advantage, which facilitates the doing of work.

Milking machine is a machine used to draw milk from a cow or other animal or a mechanical suction apparatus for milking cows. Automatic milking is the milking of dairy animals, especially of dairy cattle, without human labour. Automatic milking systems, also called voluntary milking systems

Cream separator, machine for separating and removing cream from whole milk; its operation is based on the fact that skim milk (milk with no butterfat) is heavier than cream. As milk enters the bowl at the top, it is distributed to the disks through a series of openings, the distributor

Homogenization is the process of breaking down the fat molecules in milk so that they stay integrated rather than separating as cream. Homogenization is a purely physical process; nothing is added to the milk.

Plant is a general name for machinery, equipment, appliance, implement or tool and any component or fitting or accessory of these. It can include things as diverse as presses in a foundry, underground drill jumbos in mining and photocopiers in an office.

1.1. Identifying specialized dairy machinery and equipment

The identification and selection of specialized machinery and equipment is the first step to know use the machinery and equipment for different activities in dairy production.

List of specialized dairy machinery and equipment required in dairy farm includes:-

- Milking machine and equipment,
- Milk processor (cream separator and churner)

- Calf Box
- Milk container and transport equipment
- Milk cooling tank
- Homogenizer
- Milk storage refrigerated farm bulk Tanks Pasteurize Milk
- Cream Storage
- Blend/Mix Tanks
- Tanks Dairy Equipment
- Pasteurizer

1.1.1. Machine milking

The milking machine is a nearly automatic machine installation for milking cows, goats, sheep and buffalo. It is not a single unit, but rather an assembly of components designed to handle as many as 200 cows an hour. The system consists of the cluster (the assembly that is manually attached to the cow), a milk tube, a pulse tube and pulsator, a vacuum pump or blower, and perhaps a recorder jar or milk meter that measures yield. Together, the system allows milk to flow into a pipeline in preparation for shipping to a processing plant.

Modern milking machines are capable of milking cows quickly and efficiently, without injuring the udder, if they are properly installed, maintained in excellent operating conditions, and used properly.

The milking machine performs two basic functions.

- It opens the streak canal through the use of a partial vacuum, allowing the milk to flow out of the teat cistern through a line to a receiving container.
- It massages the teat, which prevents congestion of blood and lymph in the teat.

The main parts of milking machine are

- Pulsator
- Teat cup shells and liners
- Milk receptacle
- Vacuum pump and gauge
- Vacuum tank
- Regulator

The cluster consists of teat cups, a shell and liner device that actually performs the milking action, and a claw or manifold that spaces the teat cups and connects them to the milk and pulse tubes. The milk tube carries the milk and air mixture away from the cow's udder to receiving tanks. The pulse tube, or airline, carries the varying air pressure from the pulsator device to the tanks, drawing the milk and fluids out of the cows as well.

In operation, milk is drawn from the cow's teats because a vacuum is created within the cup device, forcing the milk through the teat canal. The pulsator alternates the pressure, first creating a vacuum (milk phase), and then applying air, which causes the flexible liner in the cup to collapse and massage the teat (rest phase). The alternating process of milk-and-rest is continued in a rhythmic pattern for the cows' health and good milk productivity.

Automatic milking is the milking of dairy animals, especially of dairy cattle, without human labour. Automatic milking systems (AMS), also called voluntary milking systems (VMS), were developed in the late 20th century. Also it used to monitor the health status of cows. Today, most farmers use milking machines that are faster and cleaner, and the cows are milked in a room called the milking parlor.

The machine pulls a vacuum on the teats of the cow, causing the milk to flow. Here's how it works: As the liner opens due to the equalization of the vacuum pressure between the short milk tube and the pulsation chamber, the teat is exposed to the vacuum of the short milk tube, causing milk to flow.

Getting the machine ready and thoroughly cleaning it after milking can take about as long as it does to hand milk. The machine will milk my cow out **in 3-4 minutes**. When I hand milk it takes me about 10- 15 minutes after I get the feed in and my cow prepped for milking.

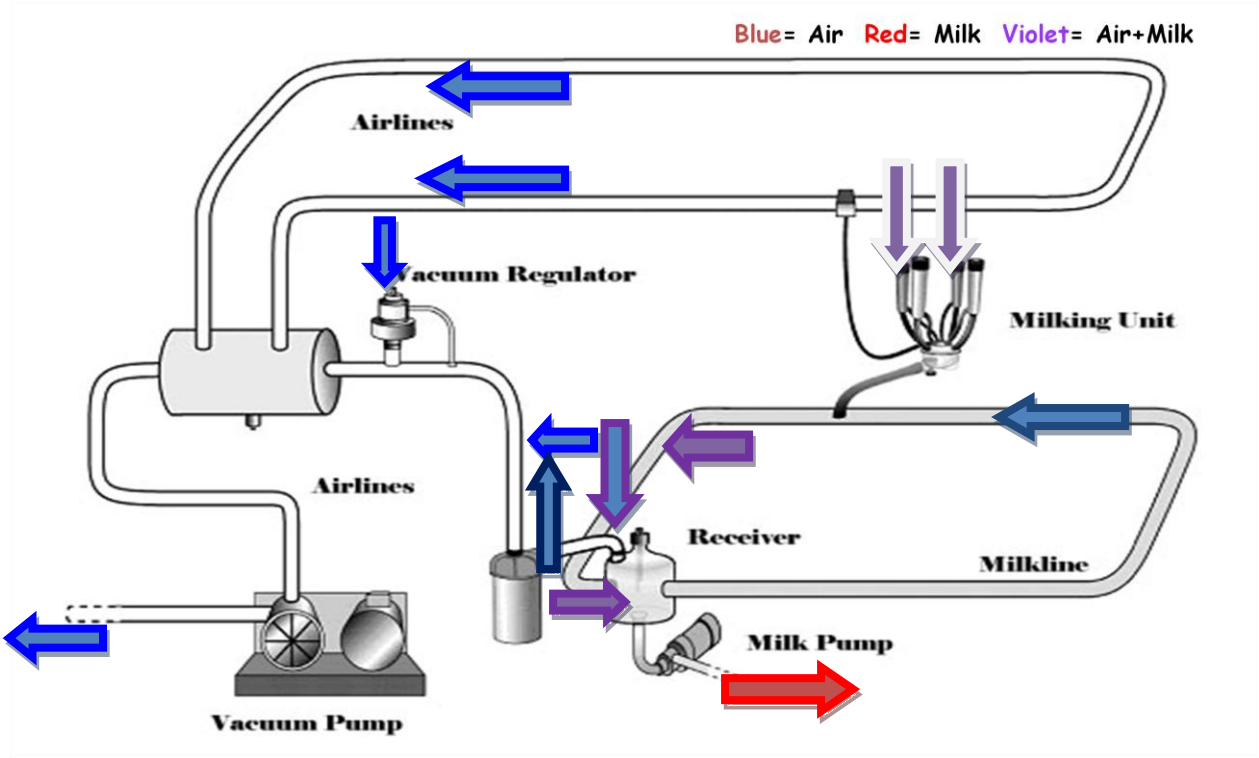


Fig 1. Air and milk movement through the machine

Milking unit

The milking unit is made up of several parts:-

- 4 Teat cups (for cows)
  - A soft rubber liner that is mounted in a metal or plastic shell
  - The soft rubber liner is the only part of the machine that touches the udder
- The claw
  - Collect milk from all of the teat cups
- The Pulsator
  - An air valve that creates ‘pulsation’ or the opening and closing of the liner
- Connecting tubes
  - Short milk tube = liner to claw
  - Long milk tube = claw to milkline
  - Short pulse tube = shell to air fork
  - Long pulse tube = air fork to pulsator

- Vacuum is applied to the inside of the liner to withdraw milk from each teat and keep the machine attached to the cow.

When the pulsation chamber is under a vacuum, the liner is open and milk flow starts. Atmospheric pressure is the applied to the pulsation chamber and the liner closes. Milk flow stops and the teat is massaged to reduce congestion.

1.1.2. Milk separation

The fat fraction separates from the skim milk when milk is allowed to stand for at least 30 to 40 minutes. This is known as ‘‘creaming’’. The creaming process can be used to remove fat from milk in a more concentrated form. A number of methods are employed to separate cream from milk. An understanding of the creaming process is necessary to maximise the efficiency of the separation process.

Purpose of cream separation

1. To obtain a fat-reduced or fat-free milk
2. To concentrate milk fat for the production of high-fat products
3. To standardize the fat content of milk
4. To recover fat from milk

The cream separation process has significant economic importance, as it controls the efficiency of the fat separation. The key objective is to manufacture skim milk with the lowest possible fat content, which corresponds to good separation efficiency. Knowledge of the basics of the fat separation is important for an optimal de-creaming process. Cream separation is based on the facts that fat exists in poly-disperse system in an emulsified state and that the specific density difference between milk fat (p = 0.93 g/cm3) and skim milk (p = 1.035 g/cm3) is fairly large. Basically two processes for fat separation are possible, natural de-creaming and separation with machines. Natural creaming has no industrial significance.

1.1.2.1. Milk Separation Processes

There are two methods of cream separation viz.

- Gravity Method
- Centrifugal Method

1. Cream separation by gravity method

when milk is allowed to stand undisturbed for some time, there is a tendency of fat to rise. The velocity or rate at which the fat globules rise is given by the following equation, which is

known as Stoke's Law:

$V = (2/9) * Gr2 * (ds - df) / N$

Where,

V = rate of rise of fat globule in centimeter per seconds

r = radius of fat globule

G = Force of gravity (981 dynes)

η= Viscosity of skim milk

ds = density of skim milk

df = density of fat globule

From, Stoke's Law it is observed that theoretically velocity increases with:

a. Increasing radius of fat globule,

b. Increasing difference in densities of skim milk and fat

c. Decreasing viscosity of skim milk

However, in practice the factors affecting the rate of rise of fat in gravity method of separation are:

- Size of fat globules: As the size of fat globules increases, the rate at which fat rises also increases. Larger fat globules rise faster than smaller ones. Thus, in buffalo milk gravity creaming occurs faster due to the larger fat globules than those in cow milk.
- Temperature: As temperature increases, viscosity decreases.
- Clumping: A clump or cluster acts like a single globule in so far as movement through skim milk is concerned. Thereby the effective 'r' is increased, which in turn increases velocity, as shown below

Effect of size of fat globules on its rate of rise	
Diameter of fat globule or cluster (µm)	Rate of rise (mm/h)
3.2 41.0	1.26 242

There are five various methods for separating the cream using gravity method:

i. Shallow Pan Method: Milk is allowed to stand in a pan of 10 cm depth and 45-60 cm diameter at 7°C for 24 h. During this time, cream rises to the surface.

ii. Deep Pan Method: Milk is allowed to stand in pan of 20" depth and 8 to 12" diameter at 10°C for 24 h. These tall cans have glass on one side of can and a faucet placed near the bottom. Skim milk is drawn through the faucet.

iii. Water Dilution Method: Milk is diluted with water and allows standing for 12 h at 37.7°C temperature. Water would make the milk less viscous, thus facilitating the rising of the fat globules.

iv. Scalding Method: Heating and cooling of milk slowly causes the formation of cream layer at surface of milk

v. Jersey Creamery Method: Milk is heated to 40°C using hot water in the jacketed vat and then cool to 10°C using chilled water in place of hot water in the jacket of Vat. The cream will be separated rapidly on cooling, immediately after heating the milk, by increasing the difference in densities of milk fat and serum.

Gravity method being very slow, it is no longer used commercially for cream separation.

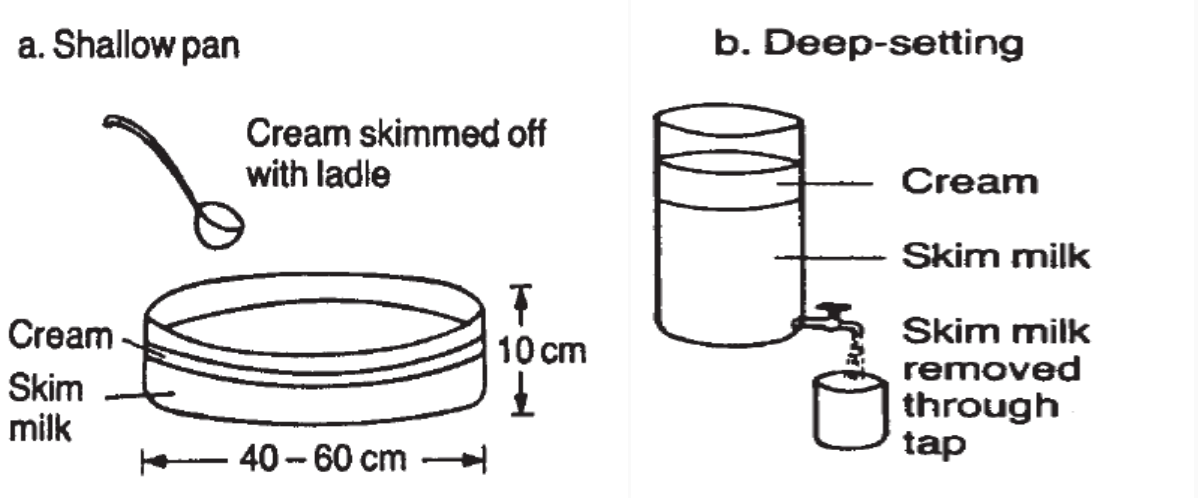


Fig 2. Gravity method milk separation

2. Cream separation by centrifugal method

Milk is fed to machine through flow regulator. Milk comes to regulating chamber from milk basin by milk faucet. When milk enters the revolving bowl through milk regulator of machine,

it is subjected to a gravity and centrifugal force. Centrifugal force is about 3000 to 6000 times more than gravitational force. Fat (0.9) and skim milk (1.037) are varying in their specific gravity. When fat and skim milk are subjected to centrifugal force, the difference in density affect the fat and skim milk i.e. (heavier Portion) affected more intensely than the fat (lighter portion). So skim milk is forced to the periphery and fat portion (cream) moves towards the centre. Cream and skim milk forms separated vertical walls within the bowl and goes out through separate outlets near the axis of rotation. The cream outlet is at higher level than skim milk outlet. The rate or movement of a fat globule in machine is estimated by following Stoke's equation.

V = r2 *((as - df) / n) * N2 * R * K

Where,

V = rate of movement of a single fat globule

r = radius of fat globule

ds = density of skim milk

df = density of fat

N = Revolution per minute of bowl

R = Distance of fat globule from axis of rotation

K = Constant

N = Viscosity of skim milk

It will be seen from the above that the speed (rate) of cream separation is increased by:

- greater radius of the fat globule
- greater difference in density between skim milk and fat
- greater speed of the bowl
- greater size of the bowl
- lower viscosity of skim milk

3. Characteristics of gravity and centrifugal methods

Gravity and centrifugal cream separation compare as shown below:

Particulars	Gravity Method	Centrifugal Method

Nature of force causing Separation	Gravitational force	Centrifugal force
Speed of separation	Extremely slow	Practically instantaneous
Direction of movement of fat and skim milk particles	Vertical	Horizontal
Bacteriological quality of cream or skim milk	Low	High
Fat % of cream	10-25% only	18-85 %
Skim milk	0.2 % above	0.1 or below
Scale of operation	Small	Large
Fat % recovered in cream	not more than 90	99-99.5

When the centrifuge bowl, filled with liquid, is put into rotation, the liquid surface level is lowered at first, and a rotation paraboloid is created. With an additional increase in revolutions, the surface level is lowered to the rotation axis and then rises in parallel. At corresponding high revolutions in the bowl a liquid ring is created. Imagine particles of skim milk and fat with the same particle diameter in a rotating liquid, the resulting force acts toward the inside. It corresponds to the force, according to motion theory, which is required to accelerate a body moving in a circle and maintain it in an orbit. This force is called the centripetal force (Fep); it is opposite to the centrifugal force Fef. In this example, the skim milk particles enter a phase in which the forces are in balance, as Fep = Fef. Because of their lower specific density, less centrifugal force is exerted on fat particles of equal size, resulting in Fep > Fef. The difference in force here is very small, so the fat particles migrate slowly toward the inside.

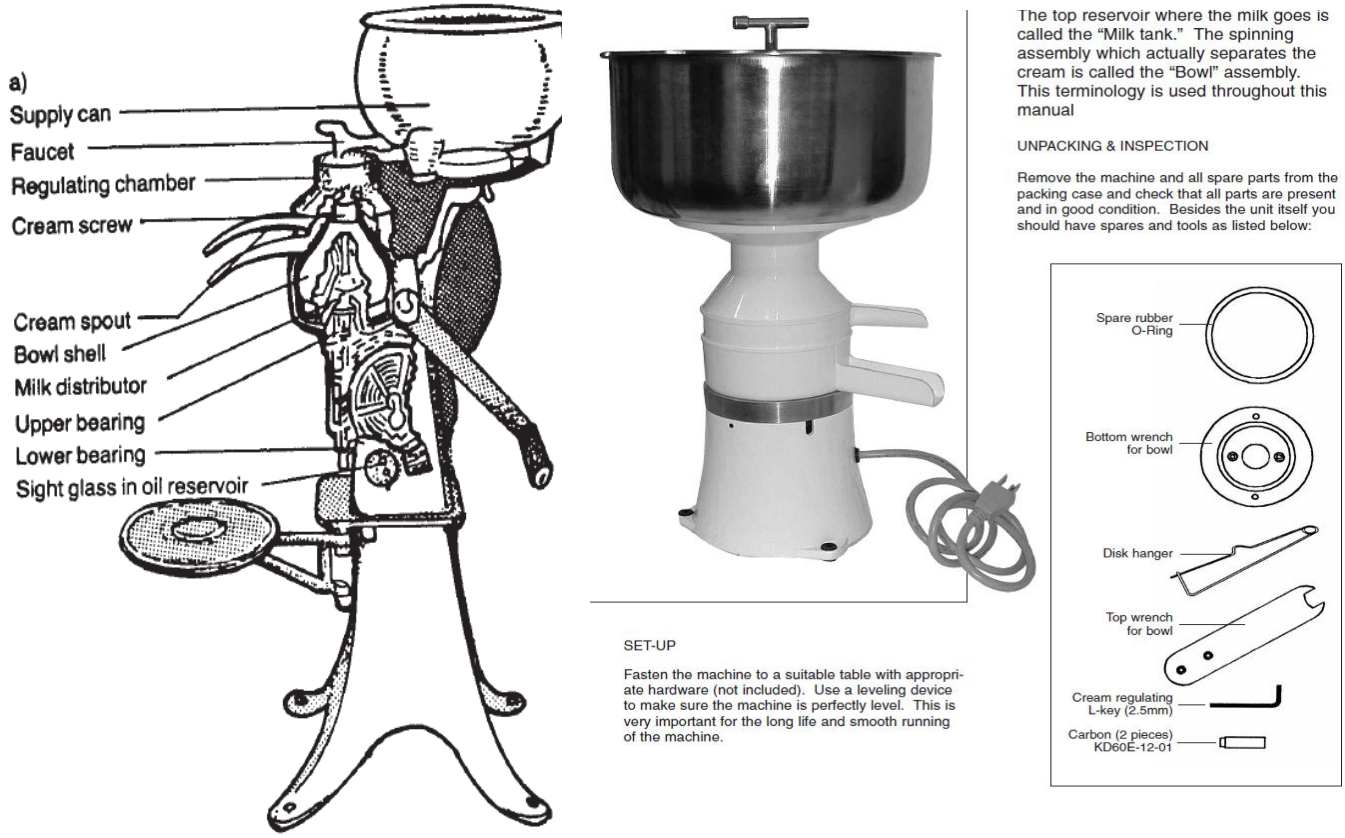
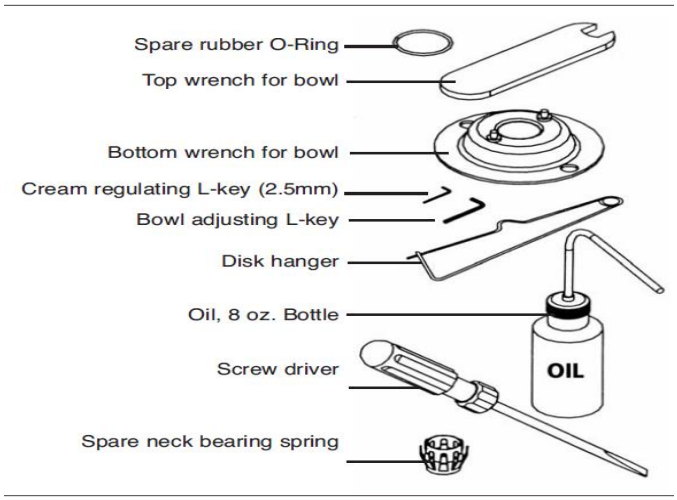


Fig 3. A). Manual centrifugal separator (b). Electrical centrifugal separator

1.1.2.2. Identifying spare parts of cream separator

The cream separator unit should have spares and tools as listed below:



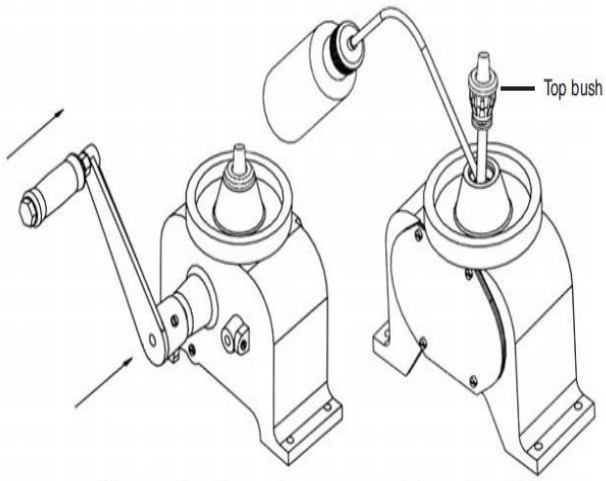


Figure C Handle attachment

Figure G Oil filling

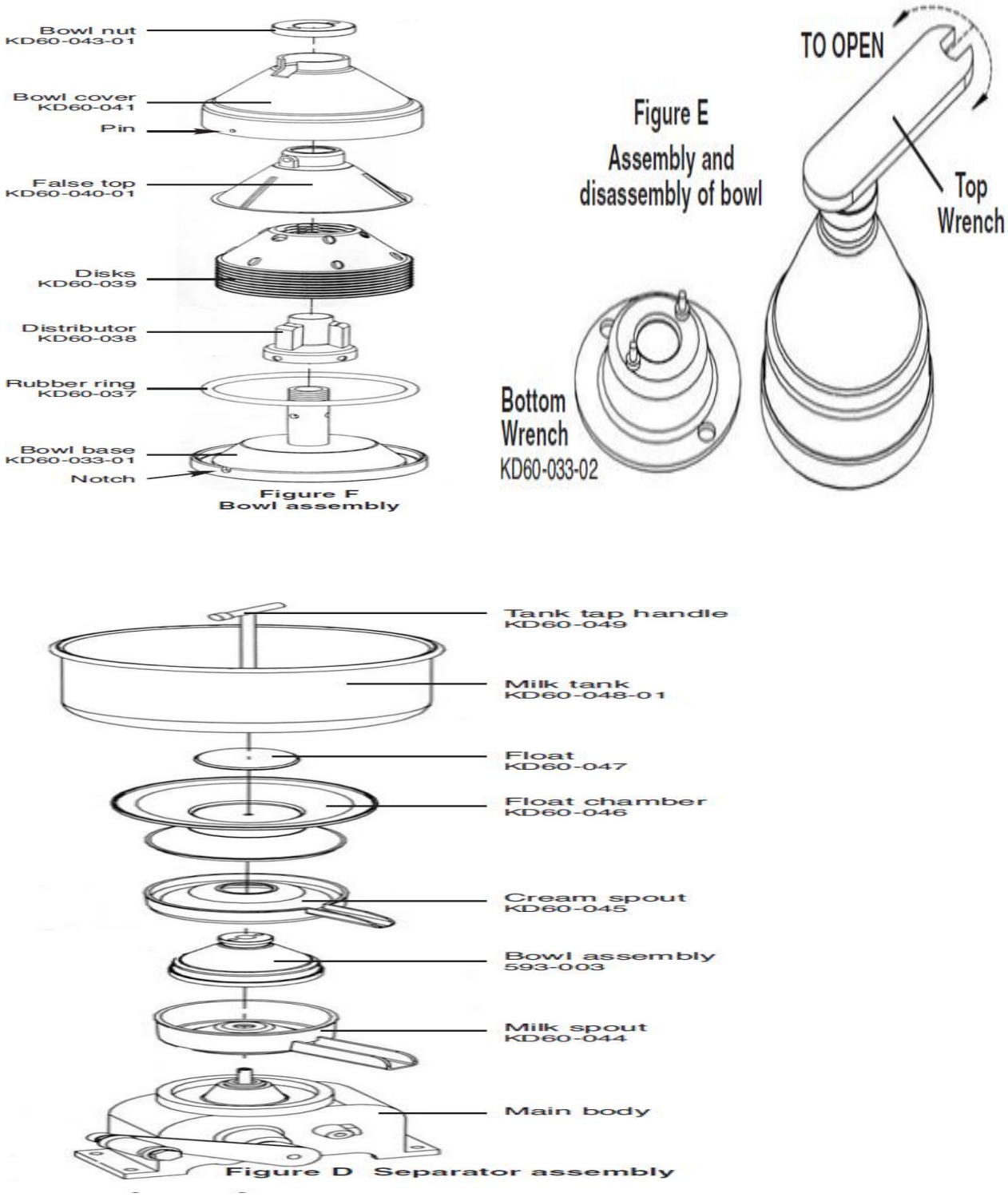


Fig 4. Spare parts of cream separator

1.2. Preparing machinery and equipment for use.

1.2.1. Preparing milking machine

Step-by-Step Milking Procedure:

Step 1. Observation

Make sure to identify cows that must be milked last or that are receiving treatment (e.g. those identified with a leg band).

Fig 5. Observation

Step 2

Fore stripping

This step is essential for detecting the early signs of mastitis. It flushes out bacteria from the teat canal and stimulates the milk flow. In tie-stall barns, use a strip cup to have a better chance of detecting the presence of clotty, stringy or watery milk. The strip cup must be cleaned and disinfected after each milking.

In the milking parlour, the foremilk can be stripped on the floor, but never into the hand since this can promote further contamination. Fore strip all quarters. If milk is abnormal, examine all quarters and teats by hand to detect early signs of mastitis (redness and warmth) or other lesions.

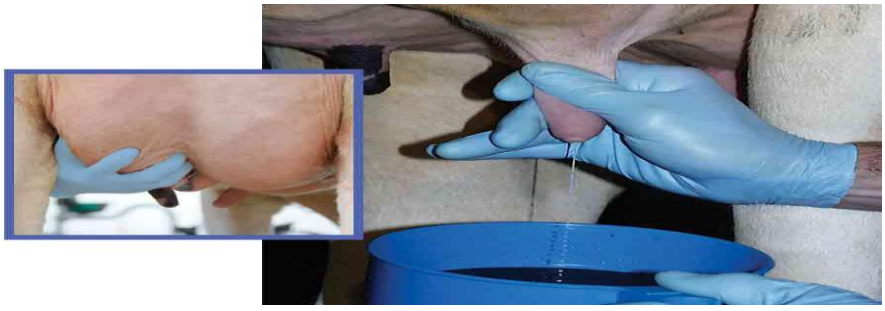


Fig 6 Fore stripping

Step 3

Cleaning the teats

Use a disinfectant solution approved by Health Canada and adjust the cleaning time depending on how dirty teats are. To be effective, the pre-dip solution must remain in contact with the teats for at least 30 seconds.

Only the teats should be wetted and then thoroughly wiped with a dry single service towel. Pay particular attention to teat ends. Alcohol swabs may be used as a test of teat cleanliness.

The order of Step 2 and Step 3 can be reversed

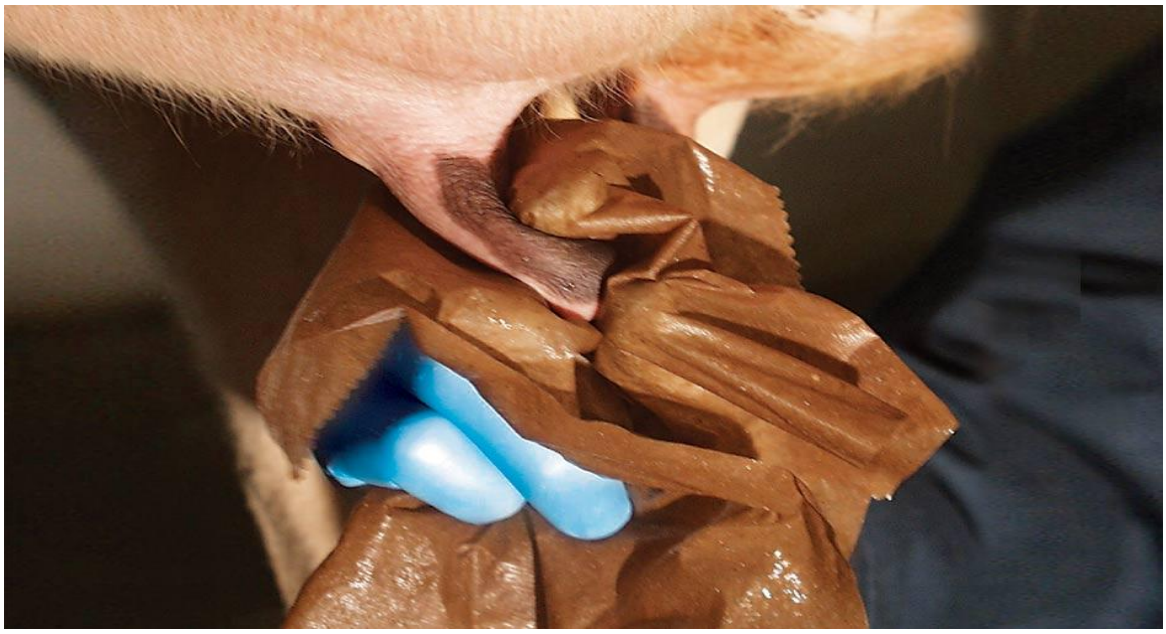


Fig. 7. Cleaning the teats

Step 4

Attaching the milking unit

The milking unit should be attached within 60 to 120 seconds after first stimulation. This time allows the milk letdown reflex to occur and maximizes milking performance.

Fig 8. Attaching the milking unit

Step 5

Adjusting the milking unit

Adjust the milking machine to avoid a twist in the hose and to obtain a square position of the four teat cups under the udder. Teat cups must be aligned vertically. The unit alignment should be such that, the claw outlet points between the cow's legs. The claw outlet should point between the cow's front legs for tie stalls and herringbone parlours and between the back legs for parallel parlours. Quickly correct any slipping teat cup.

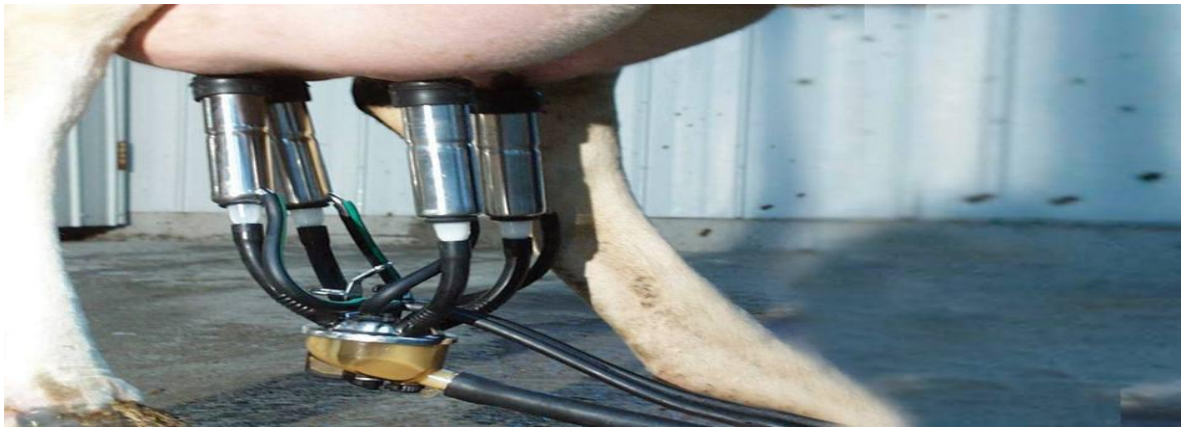


Fig 9. adjusting the milking unit

Step 6

End of milking

Complete milking should take from 4-6 minutes per cow for most cows. Observe the milk flow carefully or use milk flow indicators to determine the ideal moment for shutting off the milking unit. **Avoid over milking**.

Fig 10. End of milking

Step 7

Milking unit removal

If the claw is removed manually, always shut off the vacuum before attempting to remove the milking unit. When using automatic detachers, make sure that they are properly adjusted.

Fig 11. Milking unit removal

Step 8

Disinfection

Once milking is completed, dip the teats fully in a disinfectant solution approved by Health Canada. Teat dip cups must be clean. Discard any unused solution, clean the container thoroughly and prepare fresh solution at each milking.

Fig 12. Disinfection

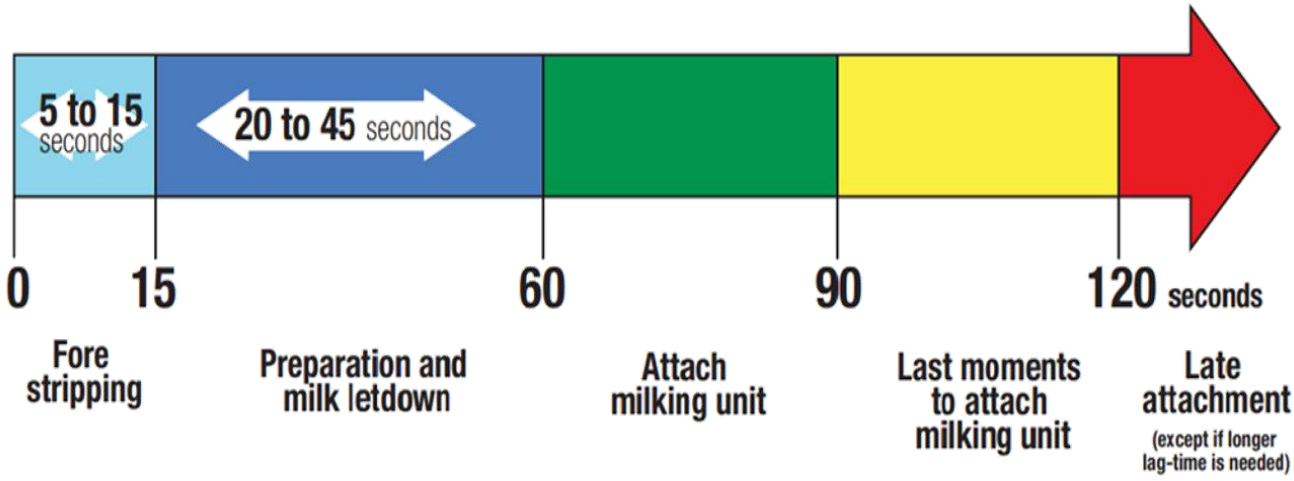


Fig 13. Stages of machine milking operation

Recommendations :

- All operators responsible for milking should always follow a consistent routine and go through the recommended steps in the proper order
- First, wash and disinfect your hands thoroughly and put clean gloves on.
- Disinfect your hands regularly during milking to avoid contamination.
- Provide a clean, low-stress environment for the animals.

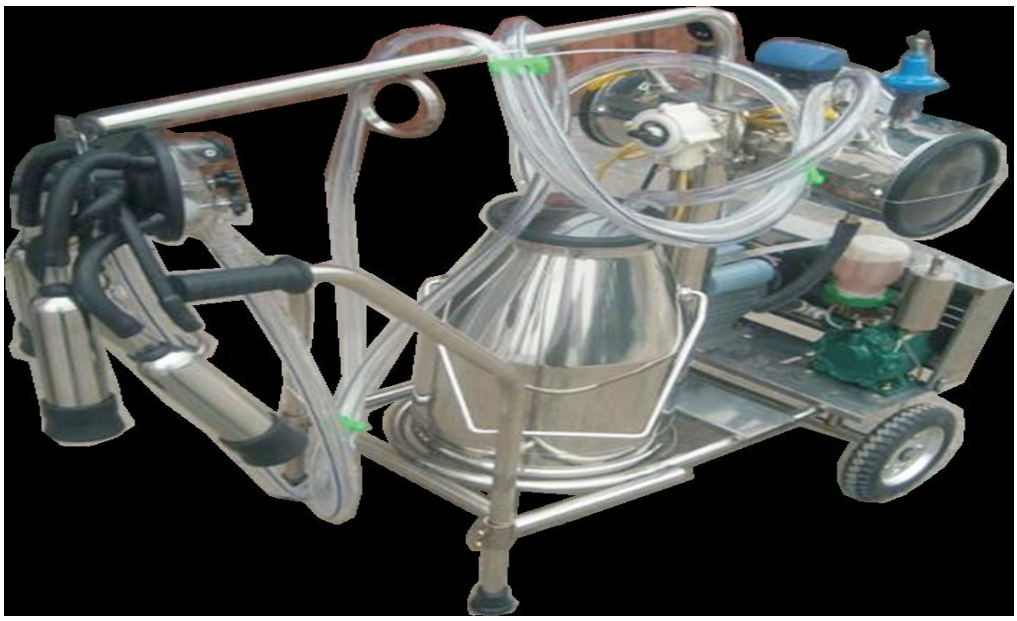


Fig 14. Electric Vacuum Single Bucket Milking Machine

1.2.2. Preparing cream separator

Set-up and oiling the cream separator

Fasten the machine to a suitable table with appropriate hardware (not included). Use a leveling device to make sure the machine is perfectly level. This is very important for the long life and smooth running of the machine. Slide the crank handle onto the shaft and tighten the screw as in Figure C. Lift the spindle and neck bearing from the top of the body (Figure G) and observe the worm gear spindle. Add about 6 ounces of oil to the gear chamber. Oil the spindle top bush. Frequently inspect and add oil as needed. Oil the top bush before each use.

Cleaning of milk contact parts

The bottom wrench should be bolted to your work table for ease of disassembly of the bowl. Dismantle as shown in Figure E and Figure F and wash all parts in soap and warm water until thoroughly clean. Rinse well and wipe dry. All the other milk contact parts shown in Figure D except the body, should be washed the same way in soap and warm water including the milk tank, float, spouts, etc. Rinse well and wipe dry. This dismantling and washing procedure must be followed before first use and after every use.

Assembly the cream separator

Put the bowl assembly back together according to Figure F. Make sure the bowl cover pin fits into the bowl base notch. Tighten the bowl nut well. Place the milk contact parts over the spindle according to Figure D starting with the 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 next and make sure the cream supply hole on the bowl is at least 2mm above the cream pan inner edge. If adjusting is required, locate the bowl adjusting nut at the bottom of the base and use the bowl adjusting L-key to raise or lower the spindle. Place the float chamber, the float and the milk tank in place as shown. Make sure the milk tank is placed with the “ON” label at the front. Tighten the tank tap handle. Put the tap in “OFF” position. Your separator is now ready for use.

Milk preparation and separation

Milk must be strained to remove any dirt or particles. 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°F (38°C). It is very important that the milk is warm and stays warm throughout the separating process. Pre-warm the separator as follows: Heat approximately 4 quarts (3 liters) of water to 150°F (66°C). Pour the hot water into the tank. Place containers under the spouts to catch the water. Begin to turn the handle, slowly at first, gradually increasing the speed to 60 - 65 rpm. Open the tap and turn the crank so the hot water flows through the separator warming the milk contact parts. Close the tap. Immediately pour 6 quarts (6 liters) of warm milk in the tank. Put in place adequately-sized containers to receive the cream and skimmed milk which will come out of the spouts. Begin to turn the handle, slowly at first, gradually increasing to 60 - 65 RPM. Turn the tap to the “ON” position while maintaining this speed constantly throughout the entire skimming process. Spin and skim 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 pour about 4 quarts of hot tap water into the milk tank and turn the handle. This will clean the last cream from the disks. When the water has run out of the milk tank, stop cranking, close tap and allow the machine to run down gradually. Do not attempt to stop the spinning by any means.

Cleaning and storage

After separating your batch of milk, dismantle the spinning bowl and clean all milk contact parts thoroughly as described above. Dry thoroughly and store in a clean dry place. Many of the impurities in the milk collect as slime on the wall of the separator bowl. This slime contains remnants of milk, skim milk and cream, all of which will decompose and ferment unless removed promptly. If not thoroughly washed the separator bowl becomes a source of microbial contamination. Skimming efficiency is also reduced when the separator bowl and discs are dirty, and milk deposits on the separator can cause corrosion.

Washing the separator

After flushing the separator with warm skim milk, the bowl should be flushed with clean water until the discharge from the skim milk spout is clean. This removes any residual milk solids and makes subsequent cleaning easier. The bowl should then be dismantled and all parts (bowl, bowl cover, discharge spouts, float supply tank and buckets) washed with a brush, hot water and detergent. Rinse with scalding water and allow the parts to drain in a clean place protected from dust and flies. This process should be followed after each separation.

Assembling the bowl

1. Fit the milk distributor to the central feed shaft.
2. Fit the discs on top of each other on the central shaft.
3. Fit the cream screw disc.
4. Fit the rubber ring to the base of the bowl
5. Put on the bowl shell, ensuring that it fits to the inside of the base.
6. Screw the bowl nut on top.

The rest of the separator is essentially a set of gears arranged to permit the spindle, on which the bowl is carried, to be turned at high speed. The gears are normally enclosed in an oil-filled case. The bowl is usually supported from the bottom and has two bearings; one to support its weight and the second to hold it upright. The upper bearing is usually fitted inside a steel spring so that it can keep the bowl upright even if the frame of the machine is not exactly level. The assembled bowl is lowered into the receptacle, making sure that the head of the spindle fits correctly into the hollow of the central feed shaft.

1.2.3. Preparing churn

Churning is the process of shaking up cream or whole milk to make butter, usually using a cream and soured whole milk The first butter churns used a wooden container and a plunger to agitate the cream until butter formed.

Step 1: Clean the Churn. Cleaning is simple with a 50/50 mix of white vinegar and warm water.

Step 2: Lubricate the Gears. This churn is almost 90 and the gears needed a little attention.

Step 3: Churn Butter. Pour in your heavy cream.

Step 4: Pour Off Buttermilk.

Step 5: Wash the Butter.

Step 6: Mold and Chill.

Fig 15. Antique Wooden Butter Churn

1.2.4. Preparing for mixing and homogenization

Mixing may be defined as a unit operation in which two or more components, in an unmixed or partially mixed state, are treated so that each unit (particle, molecule etc.) of the components lies as nearly as possible in contact with a unit of each of the other components. Physical change Mixing may aim at producing a change that is physical, for example the solution of a soluble substance. In case of dissolving a solid in a solvent mixing will take place by diffusion but the process will be slow. In this case agitation makes the process rapid.

Dispersion In case of emulsions and creams two immiscible liquids are mixed where one liquid is dispersed into other. In suspension and pastes solid particles are dispersed in a liquid by mixing.

Homogenization is defined as an intensive mixing of mutually insoluble phases to obtain a suspension or emulsion.}Homogenizer actually reduces the size of particles of one material and dissolves it evenly throughout the other material.

Working principle of homogenizer:-

1) The coarse emulsion is pumped between the valve and the seat at high pressure and high velocity.

2) As the emulsion flows between the valve and the seat, pressure decreases and velocity an increase

3) Size reduction is enhanced by the collision with the metal surface of the impact rings.

4) Turbulence occurs

5) Emulsion is then discharged.

ADVANTAGES: No air is incorporated in the emulsion→ no contamination of emulsion. The emulsifying agent gets adsorbed at the air-water boundary, causing denaturisation.

DRAW-BACKS: Increase in temperature may decrease viscosity. There are some substances (ointment) which may fail to emulsify if subjected to very high temperature. Emulsion of this type should be first treated at high temperature, then at a lower temperature.

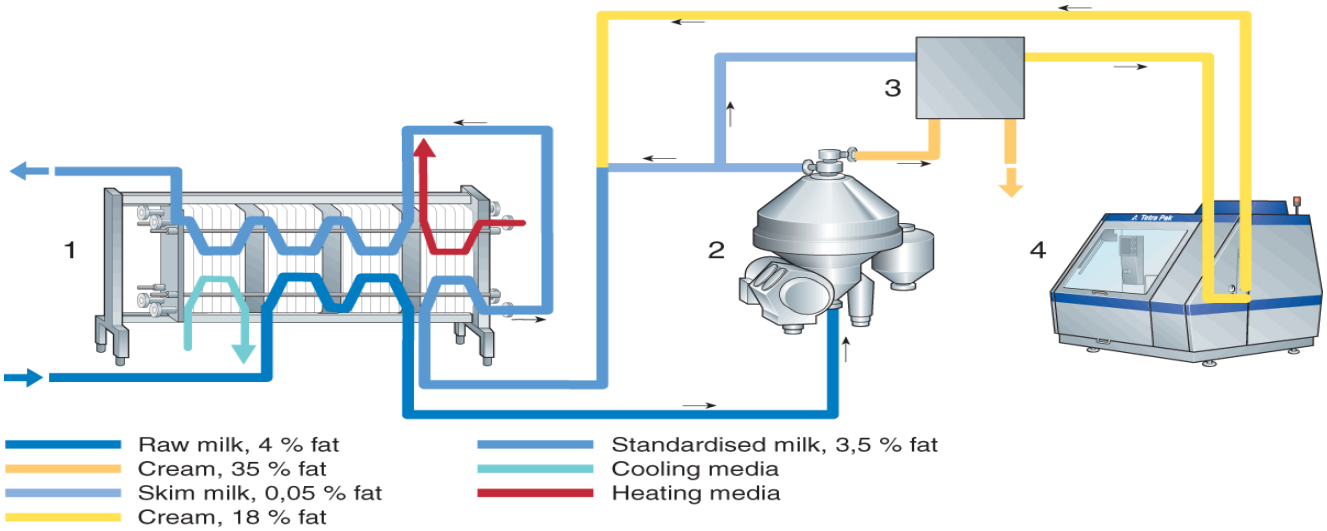


Fig 16. Diagram of homogenizer

Process requirements

The physical state and concentration of the fat phase at the time of homogenization contribute materially to the size and dispersion of the ensuing fat globules. Homogenization of cold milk, in which the fat is essentially solidified, is virtually ineffective. Processing at temperatures conducive to the partial solidification of milk fat (i.e. below 40 °C) results in incomplete dispersion of the fat phase.

Products of high fat content are more difficult to homogenize and also more likely to show evidence of fat clumping, because the concentration of serum proteins is low in relation to the fat content. Usually, cream with higher fat content than 20 % cannot be homogenized at high pressure, because clusters are formed as a result of lack of membrane material (casein). Increasing the homogenization temperature decreases the viscosity of milk and improves the transport of membrane material to the fat globules. Homogenization temperatures normally applied are 55 – 80 °C, and homogenization pressure is between 10 and 25 MPa (100 – 250 bar), depending on the product.

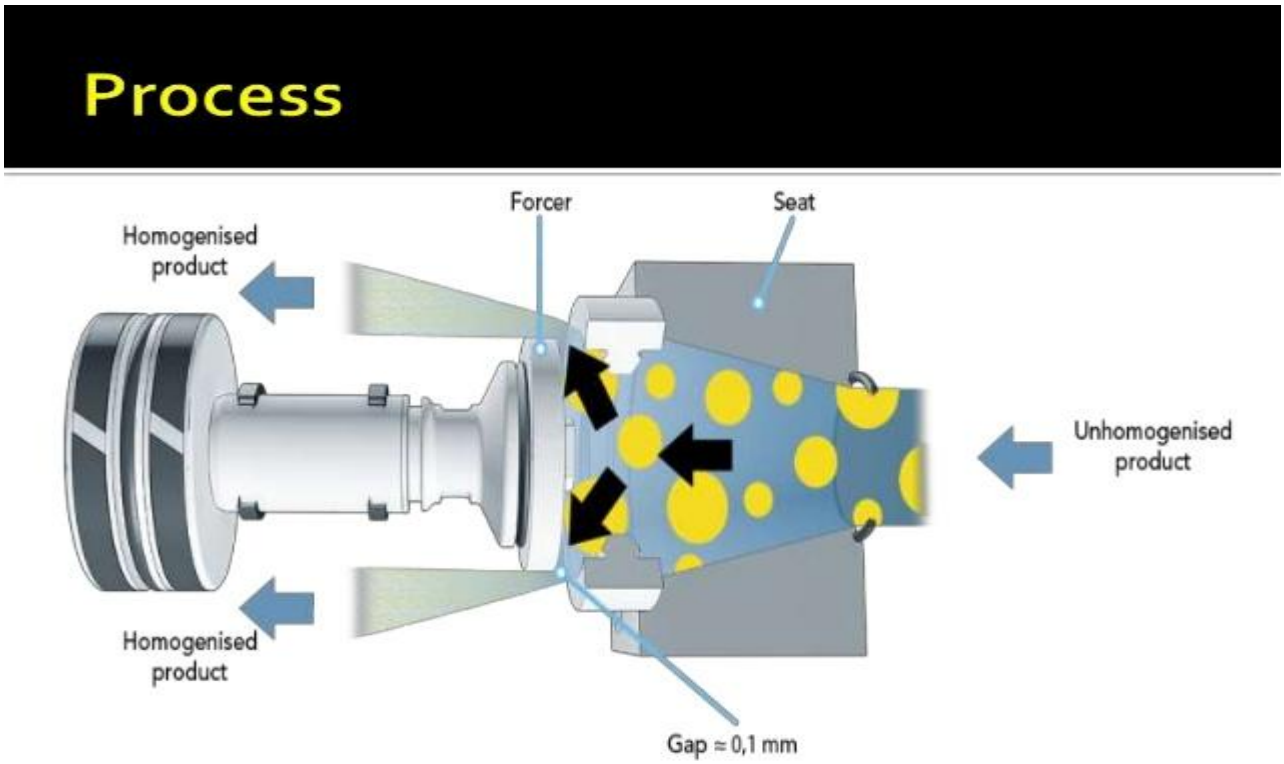


Fig 17. Processing image of homogenizer

1.2.5. Preparing pasteurization

Pasteurization is the process of heating the product to a predetermined temperature and holding it until all or nearly all objectionable microorganisms, which may be present, are killed.

Pasteurization requirements for milk

Pasteurization by heating and time treatments are a compromise among bacterial killing along with a number of other factors such as taste, phosphate inactivation, cream line reduction, etc. Pasteurization of milk, widely practiced in several countries, notably the United States, requires temperatures of about 63° C (145° F) maintained for 30 minutes or, alternatively, heating to a higher temperature, 72° C (162° F), and holding for 15 seconds (and yet higher temperatures for shorter periods of time).

Table 1. Pasteurization temperature level

Pasteurization Temperature vs. Time	
Vat (Batch) Pasteurization	
Temperature	**Time**
63°C (145°F)*	30 minutes
HTST Pasteurization	
Temperature	**Time**
72°C (161°F)*	15 seconds
89°C (191°F)	1.0 second
90°C (194°F)	0.5 seconds
94°C (201°F)	0.1 seconds
96°C (204°F)	0.05 seconds
100°C (212°F)	0.01 seconds

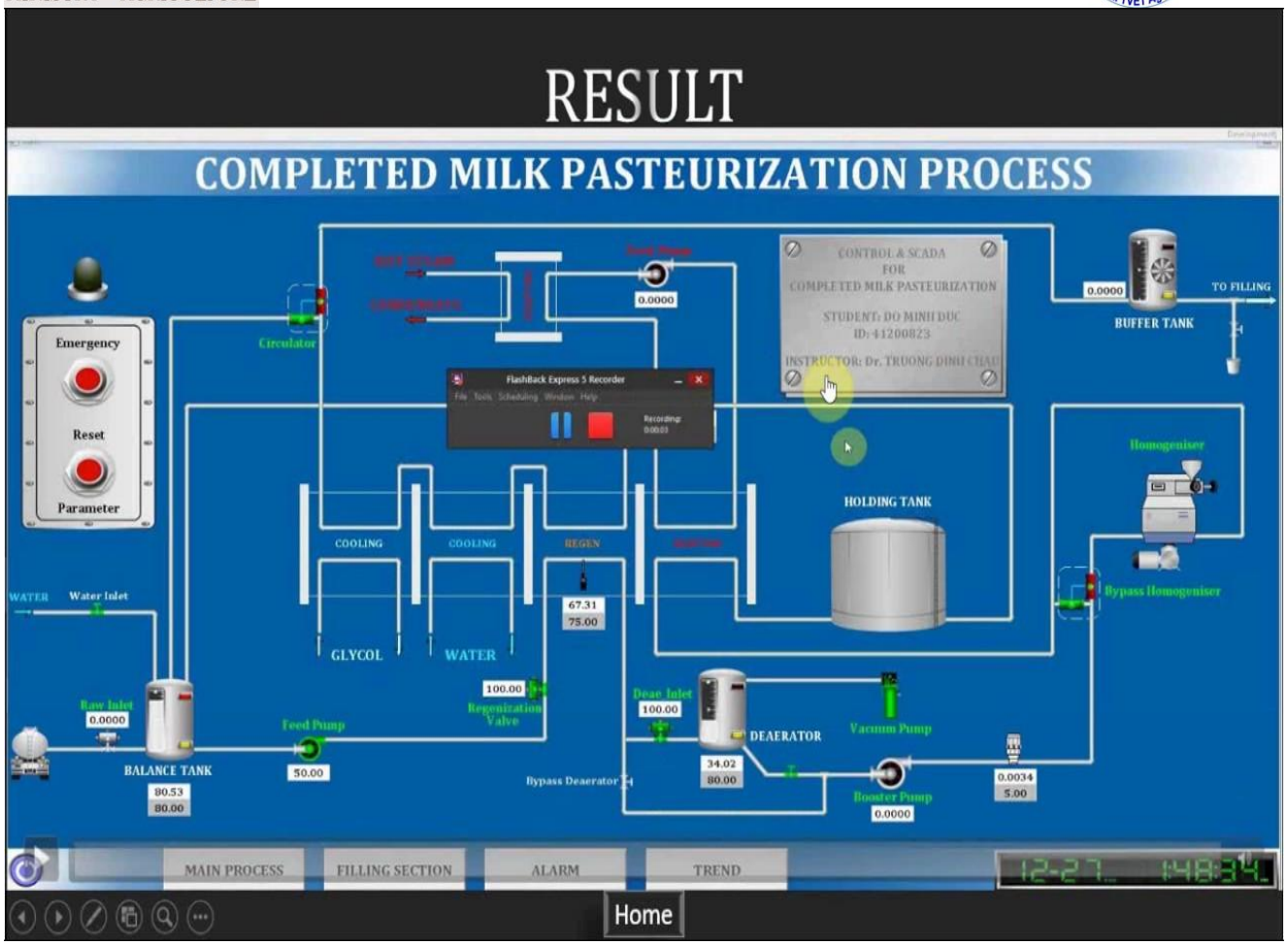
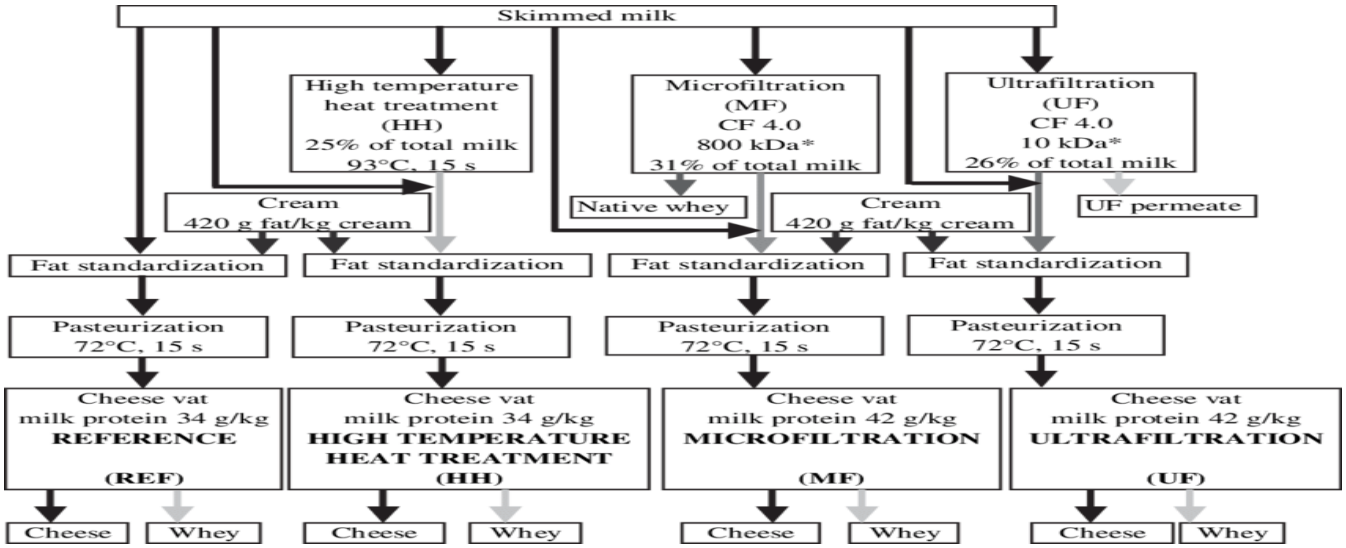


Fig 18.Completed milk pasteurization process



a) General milk processing diagram

b) Milk pasteurization

Fig19. Flow of milk pasteurization

1.2.6. Preparing cheese making

Basic Steps of How to Make Cheese

Step 1: Start With Fresh, Warm Milk. The nicer and the fresher the milk you use, the more delicious your cheese will be.

Step 2: Acidify the Milk.

Step 3: Add a Coagulant.

Step 4: Test for Gel Firmness.

Step 5: Cut the Curd.

Step 6: Stir, Cook & Wash the Curd.

Step 7: Drain the Curds.

Step 8: Salt and Age the Cheese

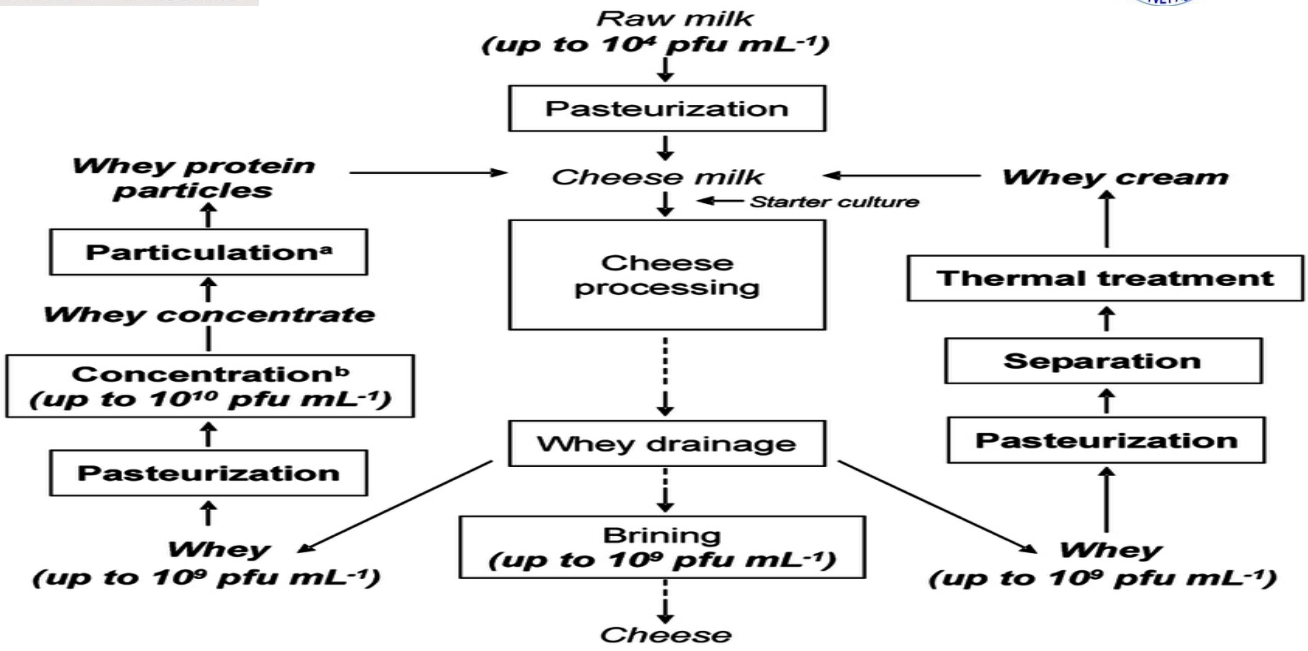


Fig 20. Flow of milk pasteurization

1.3. Storage and housing requirements for machinery and equipment

- ✓ The building, rooms and other physical facilities of the plant should be kept in good repair and be maintained in an orderly sanitary condition at all times. There should be no handling or storing of materials that create an objectionable condition in areas where product is prepared, stored or handled. Unnecessary pipes, wires, string, and other material should be removed and no trash should be allowed to accumulate.
- ✓ Storage of useful machinery and equipment should be stored in an orderly manner on elevated racks at least 12 inches high. This facilitates the necessary routine cleanup of waste and debris from all ground surfaces. Plant management must instruct maintenance and repair personnel to promptly and properly store useful items in the provided facilities.

Fig 21. Storage and housing machinery and equipment

Self-Check -1	**Written Test**

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

1. What are the specialized machinery and equipment required in dairy farm? List it (6 ts)
2. Write the principles of Gravity separation?(5pts)
3. Explain milk separation using centrifugal force?(5pts)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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2_____

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Information Sheet-2	**Completing routine pre-operational checks of specialized machinery and equipment**

2.1. **Carrying out routine pre-operational checks of machinery and equipment**

Routine checks before starting any work with a machine, including operation, maintenance or repair there are various checks that need to be followed, such as:

- The machine is suitable for the job
- All safety devices such as guards are in place and working correctly
- The operator is properly trained to do this job and use this machine safely
- The instruction manual for the machine has been provided, read and understood
- Suitable clothing is available and worn e.g. close fitting so as not to snag on vehicle and Machinery controls or be caught in moving machine components
- The right personal protective equipment (PPE) is available and worn
    - Jewelers (including watches and rings) that might snag have been removed
    - Long hair has been secured (tied back or enclosed in a hair net) in such a way that it cannot snag on vehicle and machinery controls or be caught up in moving machine parts
- a risk assessment has been carried out • the work has been properly planned and communicated to those who may be at risk
- Everyone understands what needs to be done and has a system of communication agreed on.

2.1. Checking the machine before use

Basic checks should be carried out before working with any machinery and equipment, to make sure that it is in good working order and safe to use. The requirements vary according to the machine and are available in the operator manual for the machine or equipment.

Mechanical defects checks include brakes, wheels and tyres.

Guards and other protective devices correctly fitted and maintained in good condition. They need to be in place, securely attached, working and not damaged, i.e. any damaged or defective guards should be repaired or replaced before the machine is used.

Other checks include**:**

- Stopping devices are functioning correctly, e.g. Emergency stops
- All controls should be clearly marked to show what they doIf work is to be carried out on the machine make sure it can be done safely, e.g. Check for safe access and that working platforms have guard rails etc.
- Hitching and attachment points are safely attached to the towing vehicle and attention to the condition of drawbar / pick-up hitch, and hitch rings, pins, clips etc.
- For self-propelled machines, make sure mirrors are clean and properly adjusted
- Check any other reversing aids are working
- Carryout any pre-use / pre-start checks as specified in the operator are manual.

2.3. Pre-start checks before starting and operating a machine

It is the responsibility of the operator / driver to ensure pre-start checks are carried out and recommended PPE is used. An example of pre-start checks for a lawn mower include: Blades.

- Before each use, check the cutter blades for damage or excessive wear. Never operate the mower with a worn, damaged, split or dented blade (a piece of blade which breaks off and is thrown outwards can cause serious injuries)
- To avoid severe personal injury, disconnect the spark plug cap to prevent accidental starting
- Wear heavy gloves to protect your hands from the cutter blades.

2.3.1. Checking milking machine

Check milking machine can be performed by the following manner. ISO 39189 (2007) defines four types of milking machine checks:-

1. Dry test –test made on a milking machine without any liquid.
2. Wet test –test made on a milking machine with simulated milking.
3. Milking time test –test made on a milking machine during milking of live animal.
4. Cleaning time test –test made on a milking machine during cleaning.

Self-Check -2	**Written Test**

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

1. List routine checks before starting any work with a machine, including operation, maintenance or repair.
2. Indicate the rules check milking machine.

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

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2_____

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3.1. Occupational Health and Safety (OHS)

Occupational health and safety is one of the most important aspects of human concern. It aims an adaptation of working environment to workers for the promotion and maintenance of the highest degree of physical, mental and social well being of workers in all occupations.

The discipline covers the following key components:

1. The availability of occupational health and safety regulations at workplace
2. The availability of active and functional occupational health and safety committee at workplace
3. Monitoring and control of factory hazards to health
4. Supervision and monitoring of hygiene and sanitary facilities for health and welfare of the workers
5. Inspection of health safety of protective devices
6. Pre-employment, periodical and special health examination.
7. Performance of adaptation of work to man
8. Provision of First Aid
9. Health education and safety training to the worker
10. Advice to employers on the above mentioned items
11. Reporting of occupational deaths, diseases, injuries, disabilities ,hazards and their related preventive measures at working

3.2. Hazard Identification and Assessment

Risk assessment is the determination of quantitative or qualitative estimate of risk related to a well-defined situation and a recognized threat (also called hazard). One of the “root causes” of workplace injuries, illnesses, and incidents is the failure to identify or recognize hazards that are present, or that could have been anticipated. A critical element of any effective safety and health program is a proactive, ongoing process to identify and assess such hazards.

To identify and assess hazards, employers and workers:

- Collect and review information about the hazards present or likely to be present in the Workplace.
- Conduct initial and periodic workplace inspections of the workplace to identify new or recurring hazards.
- Investigate injuries, illnesses, incidents, and close calls/near misses to determine the
- Underlying hazards, their causes, and safety and health program shortcomings.
- Group similar incidents and identify trends in injuries, illnesses, and hazards reported.
- Consider hazards associated with emergency or non-routine situations.
- Determine the severity and likelihood of incidents that could result for each hazard identified, and use this information to prioritize corrective actions.
- Some hazards, such as housekeeping and tripping hazards can and should be fixed as they are found. Fixing hazards on the spot emphasizes the importance of safety and health and takes advantage of a safety leadership opportunity.

Types of hazards

Below are the four common types of hazards you should be aware of at work.

1. Physical Hazards

Physical hazards, which can adversely affect health, include noise, vibration, ionizing and non-ionizing radiation, heat and other unhealthy microclimatic conditions. Between 10 and 30% of the workforce in industrialized countries and up to 80% in developing and newly industrialized countries are exposed to a variety of these potential hazards.

2. Ergonomic Hazards

Ergonomics, also known as human engineering or human factors engineering, the science of designing machines, products, and systems to maximize the safety, comfort, and efficiency of the people who use them. Ergonomists draw on the principles of industrial engineering, psychology, anthropometry (the science of human measurement), and biomechanics (the study of muscular activity) to adapt the design of products and workplaces to people's sizes and shapes and their physical strengths and limitations.

3. Chemical Hazards

Chemical hazards are dependent on their amount:-

- Amount
- Concentration
- Time of exposure
- Mode of entry to the body

- Age
- Sex
- Health status
- Resistance of the exposed workers

❖ The effects of chemical agents are as follows:

- Asphyxiation
- Systemic intoxication
- Pneumoconiosis
- Carcinogens
- Irritation
- Mutagencity
- Teratogenicity

4.**Biological Hazards**

Many biological agents such as viruses, bacteria, parasites, fungi, moulds and organic dusts have been found to occur in occupational exposures. In many developing countries the number one exposure is biological agents.

Hazard Prevention and Control

1. Collect existing information about workplace hazards
2. Inspect the workplace for safety hazards
3. Identify health hazards
4. Conduct incident investigations
5. Identify hazards associated with emergency and non-routine situations
6. Characterize the nature of identified hazards, identify interim control measures, and prioritize the hazards for control.

3.3. Risk control of machinery and equipment hazards

3. 3.1 Risk control of general hazards

Where exposure to machinery and equipment hazards cannot be eliminated or substituted for machinery and equipment of improved design, risk controls must be applied to the hazards to prevent or reduce the risk (chance) of injury or harm. Workplace health and safety laws require the highest order control be applied.

Higher order machinery and equipment risk controls are preventative by nature, are effective and durable for the environment it is used in, and deal directly with the hazard at its source.

Lower order machinery and equipment risk controls, such as personal protective equipment (PPE), can prevent injuries, but are generally not as effective as higher order controls, as they rely more on worker behavior, maintenance programs and supervision.

Administrative controls use systems of work to reduce risk by providing a framework of expected behaviors. Examples are rotation of staff to reduce exposure to a hazard, or a

documented safe system of work, such as 'lockout tagout'. These types of controls rely on extensive instruction, information, training and supervision. In terms of time and ongoing administration by managers and employers to ensure the desired behaviour occurs, administrative controls can be the most expensive and least effective form of hazard control.

Note: The use of **PPE** and **administrative controls** are **low** or **last order controls** used to deal with any residual risk associated with the hazard. As such, these last order controls can be used in support of higher order controls that deal with a hazard at its source and should not be considered as the sole means of control. These types of risk controls require constant monitoring and reinforcement.

- Effective machinery and equipment risk controls reflect some or all of the following characteristics:
  - the hazard is controlled at its source
  - contact or access to the hazard is prevented
  - sturdy construction (correct materials with few points of potential failure)
  - fail-safe (failure of the control system to be effective will result in machinery shut-down)
  - tamper-proof design (as difficult as possible to bypass)
  - presents minimum impediment to machinery and equipment operator
  - easy to inspect and maintain
  - does not introduce further hazards through the risk control action.

3.3.2 Risk control of mechanical hazards

Separation is a simple and effective machinery and equipment risk control and may be achieved by distance, barrier or time**.**

- Distance separation means a person cannot reach the hazard due to distance.
- Barrier separation means an effective barrier or guard denies access and controls ejection of parts, products or waste.
- Time separation means at the time of access, the machinery and/or equipment is disabled.

Examples of separation include:

- physical barriers and guards, such as fences, screens or fixed panels of various materials

• various forms of guarding and interlocking (as described in AS4024, parts 1601 and 1602, Safety of Machinery)

• making the hazard inaccessible by reach (where the distance between a person and the hazard forms an effective barrier).

Note: When considering the suitability of distance guarding, consider the safe access requirements of maintenance people who gain access by ladder, scaffold or elevated work platform.

3.3.2. Other mechanical hazard risk control options

Simultaneous two-handed operation

Where a machine has only one operator, the use of simultaneous two-handed operation buttons can serve as a risk control. This ensures that operation of the hazardous mechanism cannot occur until both hands are clear of the danger area.

Presence sensing systems

If physical guards cannot be used, then a presence sensing system can be used as a control to reduce risk. Presence sensing systems can be used where people enter areas shared by moving production equipment.

Critical safety systems

A critical safety system is a safety control system responsible for ensuring the safety of a person when approaching or accessing a hazard.

High integrity/fail-safe control

All safety control systems should be designed and built to prevent failure or, in the event of failure, de-activate the operation of the machinery and equipment.

Redundant and self-monitoring fault detection systems

Redundant or dual systems (doubling up) and self-monitoring fault detection systems are also effective methods to prevent failure of critical safety systems.

Self-Check -3	**Written Test**

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

1. Explain mechanical hazard risk control options.
2. Clearly discuss types of hazards

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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2._____

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Operation sheet-1	Prepare milking machine

Procedure:

1. Observation
2. Fore stripping
3. Cleaning the teats
4. Attaching the milking unit
5. Adjusting the milking unit
6. End of milking
7. Milking unit removal
8. Disinfection

Operation sheet-2	Prepare cream separator

Procedure

1. Set up and oiling cream separator
2. Cleaning the milk contact parts
3. Assembly the cream separator
4. Milk preparation and separation
5. Cleaning and storage of cream separator

Operation sheet-3	Assemble the bowl of cream separator

Procedure

1. Fit the milk distributor to the central feed shaft.
2. Fit the discs on top of each other on the central shaft.
3. Fit the cream screw disc.
4. Fit the rubber ring to the base of the bowl
5. Put on the bowl shell, ensuring that it fits to the inside of the base.
6. Screw the bowl nut on top.

LAP test	**Practical demonstration**

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 6 hours.

Task 1. Prepare milking machine

Task 2. Prepare cream separator

Task .3 Assemble the bowl of cream separator

Reference

1. **Handbook of Farm, Dairy and Food Machinery Paperback – 19 Oct 2010 by Myer Kutz (Author)**
2. **UNL Environmental Health and Safety · (402) 472-4925 · http://ehs.unl.edu**
3. **Milk cream separator Motor Sich SCMR-80-09 User's manual 2016**

DAIRY PRODUCTION

Level III

Learning Guide-58

Unit of Competence: - Operate specialized dairy Machinery and equipments

Module Title: - Operating specialized dairy Machinery and equipments

LG Code: AGR DRP3 M15 LO2-LG-58

TTLM Code: AGR DRP3 TTLM 1219v1

LO2:- Operate specialized machinery and equipment

Instruction Sheet	Learning Guide 58

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

- Operating machinery and equipment is in a safe and controlled manner and monitoring for performance and efficiency.
- Anticipating risks to self, others and the environment and implementing minimization strategies.
- Selecting, using and maintaining personal Protective Equipment (PPE).
- Identifying, assessing and reporting environmental implications associated with machinery operation.

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Operate machinery and equipment in a safe and controlled manner and monitor for performance and efficiency.
- Anticipate risks to self, others and the environment and implement minimization strategies.
- Select, use and maintain personal Protective Equipment (PPE)
- Identify, assess and report Environmental implications associated with machinery operation

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 1 to 7.
3. Read the information written in the “Information Sheet (**1, 2,3, and 4**) in page **3 ,8,11 and 15** respectively
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the **“Self-check 1, Self-check 2, Self-check 3” and Self-check4”** in page**, 7, 10, 14 and 17** respectively.

6. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
7. Submit your accomplished Self-check. This will form part of your training portfolio.

1.1. Safe operating procedure

SOP is intended to provide general safety guidance for power-driven (including manually operated) stationary machines and equipment used to shape and/or form metal, wood, or other materials by cutting, impact, pressure, electrical or other processing techniques. These types of machines present a number of potential hazards, which must be recognized and controlled to minimize the risk of operator injury. Hand and portable powered tools are beyond the scope of this SOP.

Safe operation of machinery and equipment necessitates that all foreseeable hazards are controlled. Effective control is achieved through a risk assessment process.

Risk Assessment Overview

The outcome of completing the risk assessment process should be:

- A clear understanding of risk(s) including the potential severity of harm and the probability of the occurrence of harm;
- Machinery with risks reduced to an acceptable level;
- Risk reduction measures appropriate to the circumstances;
- Documentation of the risk assessment."

Risk assessment process consists of several steps. For the purposes of this SOP, the following steps are emphasized:

1. Identify the tasks and hazards
2. Assess the initial risk
3. Reduce the risk to a feasible and acceptable level
4. Validate the solutions

1.2. General Safe Operating Rules

Regardless of the particular risk reduction measures selected for a particular machine, there are some general safe operating rules that must be observed:-

- Restrict access to shops and individual pieces of equipment/machines to authorized operators.

- Avoid working alone in the area so that someone is available to provide or summon assistance in the event of an emergency.
- Read and adhere to the manufacturer's operating instructions and warnings.
- Receive training in proper operation and demonstrate competency to an experienced and authorized operator for each type of task to be conducted before operating independently.
- Know the emergency stop/shut-down procedures for the specific machine operated.
- Inspect machines/equipment prior to each operating shift to ensure that:
  - Points of operation and surrounding areas are clean of debris and other hazards.
  - Shields and guards are in place and controls and interlocks or other safety devices are accessible and operating properly (pay attention to the point of operation, as well as the area behind, to the side, and above the machine).
  - Machine components are in good working condition (do not use damaged equipment).
  - Labels and warnings are present and legible
- Inspect ancillary hazard control devices for proper operation, such as dust collectors used with wood working equipment, etc.
- Do not operate equipment that is damaged or that has missing/defective guards or shields and promptly tag such equipment as "Out-of-Service" and notify the appropriate authority.
- Follow the manufacturer's recommendations for routine cleaning and preventative maintenance. Do not use compressed air for cleaning of debris.
- Do not attempt to override or defeat safety features.
  - ✓ Guards and shields must be in place during normal operation.
  - ✓ Observe appropriate Lockout/Tagout procedures when guards, shields, or other safety devices are removed or deactivated for maintenance or repair.
  - ✓ See EHS SOPs related to Lockout/Tagout for Machines and Equipment.
  - ✓ Complete Lockout/Tagout training, available as a web-based module on the EHS web page, supplemented with machine-specific training from your supervisor (or delegate).
- Operate machinery within its designed limits.
- Do not operate a machine outside of the scope of your abilities, even if it is within the machine's operating limits.

- Understand the hazards of each type of operation to be conducted, and adhere to all risk mitigation measures that have been prescribed for the machine or task
- Do not wear loose clothing or jewelry while operating machines
- Confine long hair, including restraint of ponytails and beards.
- Wear appropriate work attire and prescribed Personal Protective Equipment, including, at a minimum, safety glasses and closed-toed and slip-resistant shoes.
- Avoid distractions and actions that could interfere with good communication (e.g., headphones, loud music, etc.).
- Do not engage in horseplay.
- Restrict persons not involved directly in the operation from the immediate area. • Ensure adequate space for the machine and operator to avoid cramped conditions or creation of atmospheric or other hazards (e.g., fire, exposure to excessive heat, radiation, etc.) during operation.
- Equip shops with plumbed emergency eyewash and flush on a weekly basis.

1.3. Monitoring performance and efficiency

Machine monitoring, also called predictive maintenance or condition monitoring, is the practice of monitoring electrical equipment through sensors in order to accumulate diagnostic data.

Production Performance is Capacity of a system to meet demand for deliveries or performance. Parameters like Production availability, deliverability or other appropriate measures can be used to express production performance.

1.3.1. Condition Monitoring and Process Analysis

Most machine and process characteristics which affect quality, availability, capacity, safety, risk and cost can be continually evaluated throughout an asset's lifetime. This is essential in identifying impending failure and will be applied to critical areas identified in the reliability plan.

The current state-of-health of process plant is important information related to current information, diagnosis and prognosis of various defects, and predicted useful life in the optimisatuion of safety, quality and high production rates.

There are the obvious functions of monitoring and controlling the process for reasons of safety and product specification. Additionally, there is invaluable information to be gained from the process parameters that can give an understanding of the current health of the asset.

The definition of Condition Monitoring embraces the concept of Performance Monitoring also: The process of systematic data collection and evaluation to identify changes in the performance or condition of a system or its components, such that remedial action may be planned in a cost effective manner to maintain reliability.

1.3.2. **Applications for Machinery Performance Monitoring**

Machines and Systems for which Performance Monitoring surveys may be required on a routine basis include the following items:

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

Self-Check -1	**Written Test**

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

1. What are the outcome of completing the risk assessment process

2. Identify items for applications for machinery performance monitoring

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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2_____

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Information Sheet-2	**Anticipating risks to self, others and the environment and implementing minimization strategies.**

2.1 Anticipating risks to self, others and the environment

Identify the risks your machinery may face and learn to set up an effective risk controlling and evaluating which risks should be dealt with and implementing strategies to deal. It also looks at how to implement an effective risk management policy and resources more efficiently; allows you to anticipate what may go wrong.

❖ **Risk Identification tools and techniques**

- Documentation Reviews.
- Information Gathering Techniques.
- Brainstorming.
- Delphi Technique.
- Interviewing.
- Root Cause Analysis.
- Swot Analysis (Strength, Weakness, Opportunities And Threats) .
- Checklist Analysis.

2.2. Implementing risks minimization strategies to self, others and the environment

Risk response is the process of developing strategic options, and determining actions, to enhance opportunities and reduce threats to the project's objectives. A project team member is assigned to take responsibility for each risk response.

What is a Risk Management Strategy? A risk management strategy provides a structured and coherent approach to identifying, assessing and managing risk. It builds in a process for regularly updating and reviewing the assessment based on new developments or actions taken.

Here are some tips to help make your workplace safe.

1. Understand the risks.
2. Reduce workplace stress.
3. Take regular breaks.
4. Avoid stooping or twisting.

5. Use mechanical aids whenever possible.
6. Protect your back.
7. Wear protective equipment to suit the task.
8. Stay sober.

In order to control workplace hazards and eliminate or reduce the risk, you should take the following steps:

1. Identify the hazard by carrying out a workplace risk assessment;
2. Determine how employees might be at risk;
3. Evaluate the risks;
4. Record and review hazards at least annually, or earlier if something changes.

Control measures include actions that can be taken to reduce the potential of exposure to the hazard, or the control measure could be to remove the hazard or to reduce the likelihood of the risk of the exposure to that hazard being realized.

Self-Check -2	**Written Test**

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

1. What to do to minimize the risk and hazard list he key points.

2. What are risk Identification tools and techniques.

Note: Satisfactory rating - 7 points Unsatisfactory - below 5 points

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-3	Selecting, using and maintaining personal Protective Equipment

3.1. Select personal protective equipment

PPE is defined in the Personal Protective Equipment at Work Regulations as: 'All equipment (Including clothing affording protection against the weather) which is intended to be worn or held by a person at work which protects them against one or more risks to their health and safety.

3.2. Suitability of PPE

To be able to choose the right type of PPE, the hazards involved in the task or work environment must be considered carefully. PPE must also meet the needs of the individual. The following factors should be considered when assessing the suitability of PPE:

- Is the PPE appropriate for the risk involved and conditions at the place where exposure May occur? e.g. goggles are not suitable when full-face protection is required
- Does the PPE prevent or adequately control the risks involved without increasing the overall risk? e.g. gloves should not be worn when using a pillar drill, due to the increased risk of entanglement
- Can the PPE be adjusted to fit the wearer correctly? e.g. if a person wears glasses, ear defenders may not provide a proper seal to protect against noise hazards
- Has the state of health of those using it been taken into account?
- What are the needs of the job and the demands it places on the wearer? How long will the PPE need to be worn? What are the requirements for visibility and communication?
- If more than one item of PPE is being worn, are they compatible? For example, does a particular type of respirator make it difficult for eye protection to fit properly?

Types of PPE:

- Hearing protection
- Head protection
- Eye protection
- Foot protection
- Hand and arm protection
- Body protection
- Respiratory protection

3.3. Maintaining PPE

An effective system of maintenance of PPE is essential to make sure the equipment continues to provide the degree of protection for which it is designed. Therefore, the manufacturer's maintenance schedule (including recommended replacement periods and shelf lives) must always be followed.

Maintenance may include; cleaning, examination, replacement, repair and testing. The wearer may be able carry out simple maintenance (e.g. cleaning), but more intricate repairs must only be carried out by competent personnel. The costs associated with the maintenance of PPE are the responsibility of the employer.

3.4. **Storage for PPE**

Where PPE is provided, adequate storage facilities for PPE must be provided for when it is not in use, unless the employee may take PPE away from the workplace (e.g. footwear or clothing). Accommodation may be simple (e.g. pegs for waterproof clothing or safety helmets) and it need not be fixed (e.g. a case for safety glasses or a container in a vehicle).

Storage should be adequate to protect the PPE from contamination, loss, damage, damp or sunlight. Where PPE may become contaminated during use, storage should be separate from any storage provided for ordinary clothing.

Self-Check -3	**Written Test**

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

1. Identify types of PPE used in dairy farm machinery and equipment operation.

2. Following factors should be considered when assessing the suitability of PPE.

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

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2._____

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Information Sheet-4	Identifying, assessing and reporting environmental implications associated with machinery operation.

4.1. Identifying and assessing environmental implications machinery Operation

Environmental assessment (EA) is the assessment of the environmental consequences (positive and negative) of a plan, policy, program, or actual projects prior to the decision to move forward with the proposed action. In this context, the term environmental impact assessment (EIA) is usually applied to actual projects by individuals or companies and the term strategic environmental assessment (SEA) applies to plan policies and progammes most often proposed by organs of state.

Environmental Impacts: The organization identifies and evaluates the actual or potential aspects and impacts to the environment, whether adverse or beneficial, from its activities, services and facilities. During the evaluation process, significant impacts to the environment are determined.

Key stages in the Environmental Assessment process include: screening, alternatives, preliminary assessment, scoping, mitigation, main EIA study and environmental impact statement, review and monitoring.

The Benefits of Environmental Assessment

- Reduced cost and time of project implementation.
- Cost-saving modifications in project design.
- Increased project acceptance.
- Avoided impacts and violations of laws and regulations.
- Improved project performance.
- Avoided treatment/clean up costs

4.2. **Environmental implications**

Negative environmental impacts may result from excessive noise and exhaust emissions, the incorrect use and disposal of maintenance debris (oils containers, chemical residues), and hazardous substances (fuel, fertilizer). Impacts may also include run-off flows of water and cleaning agents from servicing, maintenance and cleaning activities, soil disturbance and dust problems from high speed and frequent traffic (including irrigation equipment).

Dairy cows and their manure produce greenhouse gas emissions which contribute to climate change. Poor handling of manure and fertilizers can degrade local water resources. And unsustainable dairy farming and feed production can lead to the loss of ecologically important areas, such as prairies, wetlands, and forests.

Self-Check -4	**Written Test**

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

1. List the benefits of environmental assessment for operation of machinery

2. Explain environmental implication of machinery operation

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1_____

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2._____

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Reference

1. A Case Study from Alma Paper Mill, Quebec, Canada
2. Alfredson, R.J. 1982. A computer based system for condition monitoring, Symposium on Reliability of Large Machines, The Institute of Engineers Australia, Sydney, pp. 39–46.
3. Menoni, S., Molinari, D., Parker, D., Ballio, F., & Tapsell, S. (2012). Assessing multifaceted vulnerability and resilience in order to design risk-mitigation strategies. Natural Hazards, 64(3), 2057-2082.
4. UNL Environmental Health and Safety · (402) 472-4925 · http://ehs.unl.edu

DAIRY PRODUCTION

Level III

Learning guide 59

Unit of Competence: - Operate specialized dairy machinery and equipments

Module Title: - Operating specialized dairy machinery and equipments

LG Code: AGR DRP3 M15 LO3-LG-59

TTLM Code: AGR DRP3 TTLM 1219v1

LO3: Complete and report on specialized machinery and Equipment operation

Instruction Sheet	Learning Guide #59

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

- Completing shut-down procedures for specialized machinery and equipment .
- Completing and maintaining specialized machinery and equipment operational records.
- Detailing and reporting malfunctions, faults, irregular performance and damage to specialized machinery and equipment
- Cleaning, securing and storing specialized machinery and equipment

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Complete shut-down procedures for specialized machinery and equipment
- Complete and maintain specialized machinery and equipment operational records
- Detail and report malfunctions, faults, irregular performance and damage to specialized machinery and equipment
- Clean, secure and store specialized machinery and equipment

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 1 to 7.
3. Read the information written in the “Information Sheet (**1, 2, 3, and 4**) in page **2 ,7 14 and 17** respectively
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the **“Self-check 1, Self-check 2, Self-check 3 and Self-check 4”** in page**, 6, 13 16 and 19** respectively.
6. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
7. Submit your accomplished Self-check. This will form part of your training portfoli

Information Sheet-1	**Completing shut-down procedures for specialized machinery and equipment**

1.1. **Carrying out Machinery and equipment shut-down procedures**

Always allow an engine to cool down at a fast idle before shutting it off. This allows the valves and pistons to cool down uniformly.

- Lower all hydraulic lift equipment to the ground.
- After shutting off refill the fuel tank when the tractor has cooled a bit. Make sure that the park brakes are locked.
- Check that there is no combustible debris near the exhaust system.

1.2. General requirements/start up

Before lockout or tagout devices are removed and energy is restored to the machine or equipment, the following actions shall be taken by the authorized employee(s) to ensure a safe start up.

A. The work area shall be inspected to ensure that machine or equipment components are in place and operational, intact, and that non-essential items have been removed from the area.

B. The work area shall be inspected to ensure that all employees are in positions of safety.

C. Affected employees shall be informed if the machine or equipment is ready for start up and that the lockout and/or tagout devices are being removed.

D. Lockout and/or tagout devices shall be removed by the authorized employee(s) who applied the devices(s).

1.2.1. Special requirements.

A. **Testing of machines or equipment.**

Situations arise in which lockout or tagout devices must be temporarily removed from the energy isolating device and the machine or equipment energized to test or positions it. The following sequence should be followed:

1. Prepare the machine or equipment for start up following the general requirements for start up/section 5, articles A-D of this procedure.
2. Energize the machine or equipment and proceed with the testing or positioning.
3. If continued servicing or maintenance is required, de-energize all systems and reapply energy control measures in accordance with the general requirements for shut down/section 4, articles A-F of this procedure.

B. Group Lockout and/or Tagout.

When servicing and/or maintenance is performed by a crew, team, department or other group, a procedure may be utilized which affords the employees, as a group, the same level of protection that is provided by the installation of personal lockout and/or tagout devices.

1. The group lockout and/or tagout procedure shall meet all the requirements of this procedure except the provisions of the procedure shall apply to the group as a whole rather than each individual.
2. One employee in the group shall be designated **"primary authorized employee".** This person shall be responsible for insuring continuity of protection
3. When more than one group is involved in servicing and/or maintenance of a machine or equipment, each group shall be considered completely separate from the other.

C. Personnel and/or shift changes.

Specific procedures shall be utilized during personnel and/or shift changes to ensure the continuity of lockout or tagout protection while providing for orderly transfer of lockout or tagout devices between off going and on coming personnel.

1. When the authorized employee who applied the lockout or tagout device is not available to remove it, that device may be removed under direction of the management lead person, by:

a. Verifying that the authorized employee who applied the device is not at the facility.
b. Making all reasonable efforts to determine the safety of removing the device.
c. Ensuring that the authorized employee has knowledge of the lockout/tagout status before he/she resumes work at the facility.

2. The orderly transfer of lockout and/or tagout devices between off going and on coming personnel shall be coordinated through off going and on coming supervision.

D. **Outside personnel (serviceman, contractors, etc.).**

Whenever personnel from outside servicing employees are engaged in activities which this procedure covers:

1. The on-site employer and the outside employer shall inform each of their respective lockout and/or tagout procedures.
2. Each employer shall recognize and honor the provisions of the others procedures.

1.3. General Requirements/Shut Down:

General requirement states that one or more methods of machine guarding must be used to protect operators and other employees from hazards, including those created by point of operation, in-running nip points, rotating parts, flying chips and sparks.

Guards attached to mechanical equipment protect you from the moving parts of machines. Machine guards must never be removed and if a guard is damaged or missing, the machine must not be used until it can be repaired or replaced. A missing or damaged guard must be reported at once.

The following are some examples of machines requiring point of operation guarding:

- Guillotine cutters.
- Shears.
- Alligator shears.
- Power presses.
- Milling machines.
- Power saws.
- Jointers.
- Portable power tools

General Requirements/Shut Down:

A. **Preparation for shut down.**

The affected and/or authorized employee(s) shall evaluate the machine or equipment to be shut down to determine the type(s) and magnitude of the energy, how the hazards of the energy can be controlled, and the method or means to be implemented to control the energy.

B**. Shut down of the machine or equipment.**

The machine or equipment shall be turned off or shut down utilizing the procedure which provides an orderly shut- down that avoids any additional or increased hazard(s) to employees, or property, as a result of the equipment de-energization.

c. **Isolation of machine or equipment.**

All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated by the authorized employee(s) in such a manner as to isolate the machine or equipment from the energy source(s).

D. **Installation of Lockout and/or Tagout device(s).**

1. Lockout and/or tagout devices shall be affixed to each energy-isolating device by the authorized employee(s) responsible for making the repairs.

2. Lockout devices, where used, shall be affixed in such a manner so as to hold the energy isolating device in a "safe" or "off' position.

3. Tagout devices, where used, shall be affixed directed to the energy isolating device, or located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device. A tagout device, when used, shall be affixed in such a manner as will clearly indicate that the operation or movement of the energy isolating device(s) from the "safe" or "off" position is PROHIBITED.

E. **Dispersion of stored energy.**

1. Following the shut down of machines or equipment and after the application of lockout and/or tagout devices to energy isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, or otherwise rendered safe.

2. If there is a possibility of re-accumulation of stored energy to a hazardous level while the machine or equipment is shut down, the process of dispersion of stored energy shall be continued until servicing or maintenance is complete.

F. **Verification of energy isolation prior to starting work on** machines or equipment that has been locked out and/or tagged out.

The authorized employee(s) shall verify that isolation and de-energization have been accomplished.

Self-Check -1	**Written Test**

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

1. What are General requirements for shut down and start up the machine.

2. Indicate some examples of machines requiring point of operation guarding.

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

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2._____

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Information Sheet-2	Completing and maintaining specialized machinery and equipment operational records

2.1. Maintaining operational records of machinery and equipment

Operators should check all moving parts for excessive wear. On air planters, the condition of the cutoff brush is very important and should be adjusted properly.

Finally, lubricate all moving parts and inspect all chains and other drive mechanisms for excessive wear or misalignment.

- Inspect all equipment for broken, bent or worn parts. Repair or replace as necessary.
- Apply touch-up paint to scratched or rusted areas.
- Apply a generous coating of wax to help equipment fight the effects of the elements.
- Store equipment in a shed or under a tarp or heavy plastic if possible.

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

2.2. Types of equipment maintenance systems

2.2.1. Preventive maintenance

This is the persistent and systematic procedure for the care of all production, control and auxiliary machinery in a livestock factory including regular servicing, upkeep and overhaul, record keeping and stocking of essential spare parts for the purpose of preventing breakdowns and emergency shut downs for repair.

Preventive maintenance must begin with the purchase of the right type of equipment for any specific job. The machine must always do the job of its right capacity for high durability. If a machine that is of low capacity is consistently being called upon to do a job meant for a high capacity one, no amount of preventive maintenance will cure it!

- ❖ Preventive maintenance is useful and necessary because it will prevent loss of money and profits due to:
  - Unnecessary machinery shut downs

- Shortened machine life
- Machine inefficiency and
- Reduced productivity

The main objective of preventive maintenance is to:

- Increase the efficiency and improve the performance of machines and service equipment
- Increase the overall productivity of the entire plant by achieving coordinated and continuous operation of all plant equipment
- Increase the certainty of meeting daily production schedules
- Reduce unscheduled down time
- Extend the useful life of all plant equipment
- Minimize property and personnel hazards.

2.2.2 Elements of preventive maintenance program me

A good preventive maintenance (PM) program me must include the following elements:

- Routine external inspection of all machines and equipment
- Periodic internal inspection
- Systematic lubrication
- Prompt adjustment, repair or replacement of defective part(s)
- Record keeping system
- Periodic analysis of system(s) operating parameters
- Spare parts inventory and inventory control
- Scheduled major overhaul of machinery
- Economic basis for scrapping off of equipment
- Maintenance cast analysis and reporting to management
- Capable maintenance supervision

All the above elements are essential for an effective PM programme. None should be overlooked or ignored. From the above, a more comprehensive definition of PM should be: Preventive Maintenance is a procedure utilising programmed and coordinated lubrication, internal and external inspections, timely adjustments, repairs and replacements performed by skilled and trained personnel under qualified supervision., fair the purpose of preventing

unscheduled down time, preserving equipment, maximizing overall plant performance, minimizing maintenance costs, and thereby contributing to an improved profit position" (Newcomer, 1981).

2.2.3. Economical Maintenance

The secret of economical upkeep is to train operators to handle the equipment as if it were their own, and to keep a continuous inspection for the small things that go wrong. This should be supplemented by a periodic general inspection. In small plants, it is advisable for each operator to take care of the equipment he/she runs, when minor repairs are needed since there is seldom an engineer around. In large plants, a trained engineer should usually be available for all required repairs.

2.3. Common maintenance procedures

2.3.1. Lubrication

Lack of lubrication is one of the principal causes of machine/equipment breakdown. The best solution is to have a regular lubrication schedule, and perhaps a lubrication chart for each machine, setting the frequency of lubrication, type of lubrication needed, and places to be lubricated.

Modern equipment calls for certain types of lubricants for certain types of bearings e.g. light, high speed bearing will require a light oil, whereas a heavy duty, low speed bearing will require heavier oil.

Bearings that are operated at high temperatures must have a lubricant specially adapted for this use, just as those bearings that operate at extremely low temperatures will require zero oil.

Many dairy plants have rather high humidity and for that reason the moisture problem should be considered. Certain lubricants are available that resist rusting and corrosion due to moisture. There are also oils that resist emulsification with water and are advantageous for flooded systems of lubrication where gears and chains run in oil.

The most tightly enclosed oiling system will with time allow moisture to accumulate. It is essential to occasionally check the oil in an enclosed drive to make certain it is not contaminated with water. Usually the water will collect at the bottom and may be drawn off easily.

2.3.2. Handling of Lubricants

In many cases, bearing failures may be traced directly to improper lubrication responsibility and to the handling of lubricants. Some of the factors concerned are:

- Centralised Lubrication Responsibility. Lubrication responsibility should be given to a trained specialist who is fully familiar with the most exact lubricating requirements of the equipment.
- Planned Lubrication Schedules. Schedules outlining the type of lubricant to be used and lubrication frequency should be established and followed to the letter.
- Lubricant identification. Frequently the product loses its identity after being received by the used and becomes just another barrel of grease. Good housekeeping will assure clean and well marked containers.
- Lubricating Devices. Adequate lubricating devices should be supplied for proper lubrication. Proper lubricating devices make it easier for personnel to maintain an adequate lubricating schedule. The use of Teflon for bearing has increased greatly. It is a self lubricating plastic material.
- Accessibility of Lubricating Devices. Lubrication devices should be placed in accessible locations to ensure safety of the operators and to encourage attention to lubrication.

2.3.2.1. Indications of Faulty Operations of Anti-friction Bearings

Faulty anti-friction bearing operation can sometimes be distinguished by abnormal noises. Accurate diagnosis, however, is possible only if the bearing is dismantled and inspected. Some of the defects that cause noisy bearing operations are:

- A scraping noise indicates the presence of foreign bodies e.g. metal chips, dirt of sand.
- A regular grinding noise indicated cracked belts or rollers; and irregular grinding noise may indicate that the bearing cage is rubbing against the inner or outer race.
- A clear, metallic ringing, almost a whistle, indicates lack of lubricant
- A jotting noisy indicates surface crumbling or races and rolling elements out of line. Another cause is hardened deposits on the roiling elements resulting from lubricants of poor quality or improper type.

- Alternatively strong and weak rattling indicates a loose ball or roller or too much play in the bearing cage.
- A regular humming sound indicates that the bearing is in normal operation.

2.3.2.2. Over or under-lubrication

- Over lubrication causes overheating and waste of lubricant.
- Under lubrication results in excessive wear, overheating due to friction and as a result reduced bearing life.
- If a high speed, antifriction bearing equipped with a grease fitting is pumped full of grease, the grease increases in volume, and excessive pressures and temperatures result because of the churning of the lubricant and the resulting rise in temperature.
- It is recommended that a bearing be padded or filled not more than 1/3 or 1/2 full. This will allow the grease, under operating conditions, to expand without building up excessive internal pressure.

2.3.2.3. Contamination and Corrosion

The presence of abrasive contaminants such as dirt, dust, metal particles, hardened grease deposits and other foreign materials is probably the principal source of antifriction bearing damage and failure. The other important cause for bearing trouble is corrosion resulting from moisture introduced by handling or by exposure to excessively wet conditions and inadequate sealing.

Grease containers should be kept covered, grease dispensing equipment should be cleaned, grease fittings should be wiped clean before refilling.

2.3.3. Lubrication of Equipment.

The direction on how to lubricate equipment given by the manufactures should always be followed. Below is given some general facts of how to lubricate and what type of lubricants to use when lubricating the most common types of dairy equipment.

Motors. How to lubricate motors will depend on what type of bearings is used. Sleeve type bearing are usually lubricated with oil fed by a ring oiler, or if a it is small motors by felt wick. The type of oil used for these barings are oil with viscosity of 300-500 seconds at 100^0 F. For anti-friction bearings a multipurpose grease of medium consistency is recommendable

Speed Reducers. Reducing gears and their bearings are almost invariably enclosed in oil tight housing, which has filling level testing and drain plugs. Well-refined oils containing an oxidation inhibitor provide the best results. Depending upon gear types and other design and operating factors, the oil used can have a viscosity of 300-2000 seconds at 100°F; it should as well be rust-inhibited and foam inhibited.

Conveyors. All bearings should, if the design permits, be lubricated with a water repellent grease, as forcing grease into bearings forces dirt out and provides a seal against the entrance of all kind of foreign materials. If the bearings have to be lubricated by oil, oil of a rust-inhibiting type with a viscosity of 300 seconds at 100°F should be used. The chains are often lubricated by soap-water solution.

Air compressors and vacuum pumps. The viscosity of the oil used for both vacuum pumps and air compressors affect the operating efficiency very much. If oil with too low viscosity is used it will pass the rings, and the result will be increased oil consumption and inefficient pump operation. It should be kept in mind that compressor oils should march the pressure and temperature conditions. The type of oil used should be rust and oxidation inhibited, non-foaming and have a viscosity of 300 seconds at 100^0 F.

2.4. Corrosion of dairy equipment.

Corrosion of dairy equipment is one of the major dairy equipment problems, as it accounts for great annual loss to the industry.

Corrosion is caused by an electrochemical action which takes place in the presence of moisture and causes the surface to pit or rust. The best protection for the exterior surfaces of the dairy equipment is to keep them well painted with a good quality moisture proof and heat resistant paint. Some parts, however, can better be protected by some of the metallic coatings e.g. galvanising, tinning or chrome plating.

Corrosion and pitting of the interior surfaces of vats and machinery are best prevented by attention to proper cleaning methods and by keeping the equipment as dry as possible when not being used. Aluminium plate is hung in the vat to prevent electrolytic corrosion of tinned copper vats in some plants.

Proper ventilation of the dairy plants will reduce casting and maintenance since moisture will not collect on the surface of the equipment and remain there for long. Ammonia is corrosive

Self-Check -2	Written Test

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

1. List the Indications of Faulty Operations of Anti-friction Bearings.

2. What are the effects of over and under lubrication

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

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2._____

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Information Sheet-3	**Detailing and reporting malfunctions, faults, irregular performance and damage to specialized machinery and equipment**

3.1. Recording and/or Reporting Damage, Malfunctions or Irregular Performance of Machinery and Equipment

Unsafe or faulty machinery and equipment means machineries and equipments that are already breakdown or worn out and requires repair or replacement in order to make safe and risk free working environment for operators.

Maintenance management involves 4 simple steps to help you carry out seamless maintenance routines

1. Generating a request
2. Carrying out maintenance sessions
3. Recording information
4. Reporting the results

This may include a space for users to indicate what spare parts, such as bulbs, were used. On a regular basis, the list of spare parts used should be noted in the central maintenance and repair record so that more spare parts can be ordered.

All tools, equipment and vehicles must be properly maintained so that workers are not endangered.

3.2. General requirements for equipment maintenance

General requirements for equipment maintenance includes:-

- Obtaining a copy of the maintenance schedule recommended by the manufacturer.
- Ensuring that maintenance is performed as required.
- Ensuring that the person(s) performing the maintenance are competent (e.g. licensed mechanic).
- Retaining records of maintenance/service conducted.
- Specifying who is responsible for overseeing equipment maintenance and where the records are kept.

- Set up a system for removal and tagging of damaged or defective tools and equipment.

3.3. Handling of Machineries and equipment

Handling of machineries and equipment starts from cleaning it before and after operation. Some machinery needs cleaning in every operation interval.

Safe operating techniques and experience is major task in handling machineries and equipment's. Safe operation begins from reading and understanding the operator manual for the machine and equipment. Then procedural performances of actions and cares before starting, during starting, after starting and when stopping the machine as well as the equipment is sequentially considered.

When stopping the engine: - apply parking brake, disengage any attachments, connections, PTD… and engage the lower gear, stop the engine and remove the key. If equipped with disconnect switch, turn it off before leaving the cabin.

During performing electrical work on the machine body, or on the attached implements, always be alert to disconnect the battery and electronic boxes and connections. Furthermore watch out plastic components like hoes, seals etc. are not overheated.

After every operation, machines and equipment should be cleaned. Because dusts soils and mud and other impurities may wear the parts. Clean parts are used to observe visual sections.

Self-Check -3	**Written Test**

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

1. Put the general requirements for equipment maintenance.

2. Maintenance management involves 4 simple steps to help you carry out seamless maintenance routines. what are they.

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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2 a._____ b _____

c_____ d _____

Information Sheet-4	Cleaning, securing and storing specialized machinery and equipment

4.1. Cleaning, securing and storing machinery and equipment

All equipment should be thoroughly cleaned with a high-pressure washer to remove dirt and trash residue. Accumulated trash and dirt can create fire hazards, electrical malfunctions, corrosion and rust of equipment, which may result in breakdowns next season.

Once equipment is clean, farmers should thoroughly service and lubricate the machine. Also check for worn belts, loose bolts, oil leaks and the condition of all hoses, in addition to operational/ performance checks. Off-season is the time to make those necessary repairs and adjustments to avoid undue downtime during the next busy season. Oftentimes, implement dealers offer service specials during the off-seasons, which can mean real savings.

The store for the machinery and equipment should be

- Completely shade
- Away from house from human and animal
- Dry
- Clean
- Near to the field

Machineries can be stored for long or short period of time

Long time storage: - when machineries or equipments are stored for long time without operation they must be stored in a leveled and well ventilated room. The room should prevent the machine from rain and sun light as well as excessive dusts and impurities. Long time storage can be for one year.

After that the engine would be started, warmed up and reheated for an extended period of storage.

If the engine will **not be used for more than 6 months** the following recommendations for starting and removing from storage will help to minimize corrosion and deterioration.

- Change engine oil and replace oil filter, used oil will not give adequate protection
- Service air cleaner
- Draining and flushing cooling system is recommended and refill with the appropriate coolant.
- Remove V-belts of fan/alternator
- Remove and clean batteries, store them in a cool dry place and keep them fully charged
- Disengage the clutch for any drive line
- Clean the exterior of the engine with salt free water and paint any scratched or chipped painted surfaces
- Coat all exposed metal surfaces with grease or corrosion inhibitor if not feasible to point.
- Seal all openings on engine with plastic bags and tape
- If the machine must be stored outside a room, store it on a dry protected place and cover it with a water proof canvas or another suitable protective material wipe it with strong water proof tape
- Equipment will also be stored in the same condition
- Clean the entire parts with salt free water
- Paint or grease parts that are exposed for corrosion
- Seal all openings of connections with the prime movers etc.

Self-Check -4	**Written Test**

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

1. The feature of machinery and equipment storage area.

Note: Satisfactory rating - 6 points Unsatisfactory - below 5 points

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1_____

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Reference

1. IDF. 1990 Handbook of Milk Collection in Warm Developing Countries. IDF Special Issue 9002
2. UNL Environmental Health and Safety · (402) 472-4925 · http://ehs.unl.edu

Trainers prepared the TTLM with their full address

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