DAIRY PRODUCTION

Level II

Learning guide - 56

Unit of Competence: - Assist in Dairy Farm Machinery and Equipment Operation

Module Title: - Assisting in Dairy Machinery and Equipment Operation

LG Code: AGR DRP2 M15 LO1-LG-57

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LO1:-Prepare machinery and equipment for use

Instruction Sheet	Learning Guide 34

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

- Selecting appropriate machine and equipments.
- Confirming appropriate machine and equipments
- Carrying out routine pre-operational checks of machinery and equipment
- Carrying out manufacturers specifications and enterprise requirements
- Attaching and calibrating equipment securely for operation.
- Identifying, safety tagging, and reporting faulty machinery and equipment.
- Identifying OHS hazards in workplace.
- Assessing and reporting risk.

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 appropriate machine and equipments.
- Confirm appropriate machine and equipments
- Carry out routine pre-operational checks of machinery and equipment
- Carry out manufacturers specifications and enterprise requirements
- Attach and calibrating equipment securely for operation.
- Identify, safety tagging, and report faulty machinery and equipment.
- Identify OHS hazards in workplace.
- Assess and report risk.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 1to 10.
3. Read the information written in the “Information Sheets ”1,2,3,4,5,6,7 and 8”. In 3, 26, 28, 33, 35, 39, 42, 45, and 47 respectively.
4. Accomplish the “Self-check (1,2,3,4,5,6,7 and 8) **in page -.25,27,32,34,38,41,44 and 46.**
5. Submit your accomplished Self-check. This will form part of your training portfolio.
6. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, and Operation Sheet 2” **in page 47 and 48**
7. Do the “LAP test” in page – 49 (if you are ready).
8. Reference in page 50.

Information Sheet-1	Selecting appropriate machine and equipments

Introduction

MECHANIZATION:-Agricultural mechanization, however, embraces the use of tools, implements and machines for agricultural land development, production, harvesting and on farm processing or an introduction of machines in agricultural land for completion of different operation of farming for quicker, easier and better production of foods and fibers''. As a discipline agricultural mechanization covers the manufacture, distribution and utilization of tools, implements and machines.

Definition of tools, implements, machines and machinery

A tool is the simplest physical aid used in agriculture. The power source is human labor. It embraces wide varieties such as we may get items of crude nature to precise and well-engineered ones. E.g. the spade

Hand Tools are devices that are primarily used in performing those jobs that does not require or does not involve the use of a machine or a motor. These are handled and powered solely by the person who is using these tools.

An implement is a specific type of tool much related to the power source. There is no complicated mechanism in it. It applies to any device which is relatively simple for performing a mechanical or manual operation. It performs better job than tool. E.g. the traditional plow set

Equipment The necessary items for a particular purpose. Or a tangible property other than land and building that is used in the operations of a business.

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. In other words a machine is an assembly of parts that are made of solid bodies but include in some cases fluid bodies or electricity in conductors and that transmit force, motion and energy one to another in some predetermined manner and to

some desired end (as hoisting a load, or maintaining an electric current).E.g. the row crop planter

Machinery is a collective term for machines and their parts. A machine is considered to be any apparatus that has interrelated parts and is used to perform work .To be equipped with machinery is called **mechanization.**

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 Machinery and equipment

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

What are the basic machinery and equipment required in dairy farm?

- Milking machine and equipment,
- Milk processor machine(cream separator and churner)
- Calf Box
- Milk container and transport equipment(Villon)
- Agricultural tractor
- Manure Solid Liquid Separator
- Stationary engines, spraying equipment
- Automatic Weighing system
- Feed grinders and mixer
- Pipeline (Speed line)
- Chopper
- Bucket Milking Machine
- Powered trailer and three point linkages equipment
- Vehicle
- Generator

According to your purpose select the necessary machine for the work.

1. Agricultural tractor

The tractor is such a machine, machine, which is used to pull or to push agricultural or Construction implements in the field. Agricultural tractor is a self propelled machine driven by engine applied in agriculture.

figure 1. Agricultural tractor

A. <u>Heat engine</u>. Heat engine is a machine which converts heat energy into mechanical energy. Heat is generated by the combustion of fuel. Heat engines can be further divided in to two types

(i) External combustion and

(ii) Internal combustion.

<u>B. Engine components and accessories</u>

The principal parts of such an engine are shown in figure below

1. **Cylinder: -** the cylinder of an IC engine constitutes the basic and supporting portion of the engine power unit. Its major function is to provide space in which the piston can operate to draw in the fuel, mixture or air compress it, allow it to expand thus generate power.
2. **Cylinder head**. It is the detachable portion of an engine, which covers the cylinder and includes the combustion chamber, spark plugs, nozzles and valves.
3. **Cylinder block** .It is a solid casting, which includes all cylinders and water jackets.
4. **Piston.** The piston of an engine is the first part begins movement and to transmit power to the crank shaft as a result of the pressure and energy generate by the combustion of the fuel.
5. **Piston pin.** The connecting rod is connected to the piston through the piston pin.

6. **Connecting rod**. This is the connection between the piston and crank shaft. The end connecting the piston is known as small end and the other end is known as big end
7. **Crank shaft**. This is connected to the piston through the connecting rod and converts the linear motion of the piston in to the rotational of the fly wheel.
8. **Valves**. To allow the air to enter into the cylinder or the exhaust, gases to escape from the cylinder, valves are provided, known as inlet and exhaust valves respectively. The valves are mounted either on the cylinder head or on the cylinder block.
9. **Camshaft**. The valves are operated by the action of the cam shaft which has separate cams for the inlet and exhaust valves.
10. **Fly wheel**. This is usually made of cast iron and its primary function is to maintain uniform engine speed by carrying the crankshaft through the intervals when it is not receiving power from a piston .It also helps in balancing rotating masses.
11. **Injector.** It is the component, which delivers finely atomized fuel under high pressure to the combustion chamber of the diesel engine. Main parts injector is: nozzle body and needle valve. The needle valve is pressed against a conical seat in the nozzle body by a spring. Fuel from fuel injection pump with high pressure enters the nozzle body and it lifts the needle valve from conical seat so that fuel is forced out of the injector through a small hole provided in the injector tip.
12. **Oil tank.** It provides a reservoir for the lubricating oil of the engine.
13. **Radiator.** Radiator is provided in water cooled engines. It is a device for cooling the circulating water in the engine block. This helps in transferring the heat from the water to the atmosphere.
14. **Fan.** Fan is fitted behind the radiator and has 4, 5, or 6 blades. It is fixed on the water pump shaft. It serves two purposes in the cooling system of an engine.

    A. it draws atmospheric air through the radiator and thus increases the efficiency of the radiator in cooling hot water.

    B. it throws fresh air over the outer surface of the engine, which takes away the Heat conducted by the engine parts and thus increases the efficiency of the entire cooling system.

15. **Fuel tank**. This is a reservoir of fuel which contains sufficient fuel for about 10 hrs.
16. **Preliminary filter**: This is fitted between the fuel thank and fuel pump. The function of preliminary filter is to prevent dust and foreign materials from reaching the filter.
17. **Fuel oil filter**: most diesel engines employ a two stage system of filtering. The function of a primary is to remove water and coarse particles of dusts, while that of the secondary filter is to take care of fine dust particles.
18. **Fuel feed pump**. A Pump which feeds the fuel from the tank to the fuel injection pump is called fuel feed pump. It maintains the fuel pressure in the system at a sufficiently high level to circulate the fuel through the filters.
19. **Air Cleaner**: dust entering the tractor engine is often the principal cause of wear. The ideal air cleaner should posses the following characteristics: high efficiency in dust removal from the air, small air restriction, small size infrequent need for servicing, durability etc. They are two types of air cleaners these are dry type and oil bath or wet type filters. The dry type filter cleans the air by vanes then the clean air enters to the intake manifold. The wet type air cleans the air by trapping the dirty particles in the oil bath.

Transmission

The major components of a transmission system are

1). Clutch

2). Gear transmission
3). Differential
4). Final drive

The tractor drive train has three functions.

- It transmits power from the engine to the wheel, to, hydraulic pump, and other auxiliary drivers:
- Changes the torque and speed required by the particular drive.

- Provides means for operator control with disconnected clutches and speed ratio selection for the wheel and power take off **(**PTO) drives.

1. **Clutch:** the clutch is a device used to connect and disconnect the source of power to the rest of the transmission system.
2. **Gear box:** the purpose of the gear box is to adjust the speed of the engine to the speed at which it is required to drive the tractor that is the speed of the tractor wheels. As the engine runs at high speed, and the speed required at the tractor wheels is much less, the main function of the gear box is that of speed reduction.
3. **Differential:** the power from the engine of the farm tractor is transmitted in a straight line from the engine crankshaft, through the gear box. However, the tractor wheel axle is at right angles to the crankshaft, so the power must also be transmitted at right angles. This is accomplished by a component called the **differential**.
4. **Final drive:** the last but one component in the transmission system is called the final drive, and represents one more step in the speed reduction process. The speed reduction is achieved by having a small spur gear which drives a large spur gear.
5. **Wheel and tyres**: The final component in the transmission system, to which power is delivered, is the wheel which, on most modern tractors is covered by rubber tyres.
6. **Brakes:** the brakes are basically a safety feature, although on the tractor they are also used for turning the vehicle. The disc or friction plate is fixed either on the rear axle shaft or the differential shaft.
7. **Power take off (pto)shaft:** this shaft provides a power out let from the tractor for driving stationary machines or implements pulled behind the tractor in the field. Such as combines, movers and so on.
8. **Belt drives:** they serve as a useful power outlet for driving stationary machines like feed mills, chaff cutters, and irrigation pumps.

2. **Tillage implements**

According to the equipments used, tillage operation are classified as primary tillage and secondary tillage operations: likewise tillage implements are categorized as primary and secondary tillage implements.

a. **<u>Primary tillage implements</u>:** the operations performed to open up any cultivated land with a view to preparing seed bed for growing crops is termed as primary tillage. The implements which are used to perform primary tillage operation are called primary tillage implements.

Some of the primary tillage implements are;

1. Mould board plough

Mould board plough is a very common implement used for primary tillage operations. It normally cuts a rectangular furrow cross section of the soil.

fig 2. Mould board plough

This plough also performs the following functions one a time.

- Cutting the furrow slice
- Lifting the soil
- Turning the furrow slice
- Pulverizing the soil

According to the number of ploughing bottoms in the plough, mould board can be classified as:

<u>Single bottom mould board plough</u>: usually animal operated mould board ploughs will have single bottom

<u>Multi bottom mould board plough</u>: in this type 2 0r3 mould board ploughs will be working in the field at the same time by attaching 2 0r 3 multi board bottoms to a common frame.

According the power used to ploughing, it can be classified as

Animal drawn mould board plough : animal power is used to pull the mould board in the field. Only single bottom mould board plough can be operated by animal power.

Tractor drawn mould board plough : multi bottom mould board ploughs can be hitched to the tractor and more area can be ploughed in a shorter time.

According to the ploughing pattern mould board ploughs can be classified as

One way mould board ploughs: one way ploughs throw the soil in only one direction usually to the right when seen from behind

Two ways mould board ploughs or reversible mould board ploughs: two way ploughs have 2 sets of opposed bottoms. The bottoms of two ways plough are so arranged that the right turning bottom can be quickly turned with the set, which turns the soil to the left. When you reach the end of the furrow, you raise the plough, turn around and return across with two way plough. These ploughs have the advantage that no back furrows or dead furrows are formed in the field.

3. **Sprayer**

Uses of sprayer

- Application of insecticides to control various insects and pests and acaricides
- Application of herbicides in order to kill weeds in cultivated forage
- Application of fungicides to minimize the effect of fungal diseases
- Application of insecticide to control insect peas

Knapsack sprayer  Garden Sprayer

Fig 3.Different sprayer

Sprayer parts and their functions:

1. **Tank**: it is made of corrosive resistant material, from rolled brass sheet or fiber glass or galvanized iron. It has a filter hole fitted with a filter to pour chemical into it. The tank should have rounded corners and bottom to facilitate easy cleaning through a drain plug.

2. **Pump**: pump is needed for the atomization of spray fluid. In pneumatic sprayers, air pump is used to compress air over spray fluid to force out through nozzle.

3. **Agitator:** agitation of spray materials in the tank is essential to use the full range of spray materials including powdery emulsions, fungicides and other spraying materials.

4. **Air chamber**: in a reciprocating type pump, an air chamber is provided on the discharge line of the pump to level out the pulsations of the pump and thus providing a constant nozzle pressure.

5. **Pressure gauge**: it is provided in all sprayers connected to the outlet of the pump in order to show the pressure of spray fluid.

6. **Pipes**: to distribute the chemical under pressure of various nozzles for sprayings, high pressure metallic and rubber pipes are fixed on a beam.

7. **Valves**: cut of valves are used on delivery line to stop the discharge. Pressure relief valves are used, to prevent excessive pressure and to prevent damage of the system. By pass control valves and main control valves are used to direct excess discharge or controlling the liquid flow to pump.

8. **Nozzles:** a nozzle performs the following functions

- Meters the spray fluid at desired flow rate.
- Atomizes the liquid in to droplets.
- Disperses the spray fluid in a particular pattern.
- Propels the droplets with proper impact on the target

How to select a sprayer

The following aspects are considered while choosing a sprayer for applying chemicals

- Volume of the discharge or coverage of the sprayer
- Availability of water
- Spraying is performed than dusting for flying pests
- Nature of crop requiring treatment
- Size of the equipment
- Skill of the worker to operate the sprayer
- Cost of the sprayer

1. **Mower**

Mowers are used to cut grass and other forage crops. The basic principle of cutting remains the same as scissors i.e. two sharp straight blades shear the stalk of the grass at a certain speed. This action is defined as moving.

The operating power is transmitted into a reciprocating motion. Thus with a multiple action of impact, compactness and shear, the crop is cut and the cut material left in a swath.

2. CHAIN SAW

The chain saw is one of the most useful and time saving power tools ever made. It is also one of the most dangerous. Chain saws serve a broad range of cutting needs, from small trimming jobs to felling very large trees.

1. Pump

The heart of most irrigation systems is a pump. To make an irrigation system as efficient as possible, the pump must be selected to match the requirements of the water source, the water piping system and the irrigation equipment.

Before selecting an irrigation pump, a careful and complete, inventory of the conditions under which the pump will operate must take place

The inventory must include,

1. The source of water (well, river, pond, etc)
2. The required pumping flow rate
3. The total suction head
4. The total dynamic head

There usually is no choice when it comes to the source of the water, it is either surface water or well water or well water and availability will be determined by the local geology and hydrologic conditions. However, the flow rate and total dynamic head will be determined by the type of irrigation system, the distance from the water source and the size of the piping system.

6. Combine

A combine is a machine used to harvest crops as it moves across a field. The head of the combine runs through the crop rows and cuts the stalks of the plants. The plants are then pulled through the machine and the grain is separated from the plant material. Corn, soybeans, wheat, barley, and rice are typically harvested with combines.

Fig 4. combine

A mower is a piece of equipment used to cut standing vegetation. Mowers are used to harvest forage crops, such as grass and alfalfa. After mowing, the crop may be left in rows to dry and be picked up by a baler.

A hay tatter is a machine for making hay. It is used after cutting and before windrowing. It is used to turn or scatter the hay in order to aerate the hay and speed up the process of drying as well as results in improved aroma and colour.

A hay rake (collect) is used to collect cut hay into windrows for later collection (e.g. by a baler). It is also designed to fluff up the hay and turn it over so that it may dry. A hay rake may be mechanized, drawn by a tractor or draft animals, or it may be a hand tool.

1. Baler

A baler is a piece of equipment used to harvest forage crops that have been cut, dried, and placed in rows. The baler is pulled behind a tractor and picks the dried vegetation up off the ground. Inside the baler, the material is tightly packed or wound into round or rectangular bales. When the bale reaches the proper size, the machine wraps the bale with wire or twine to secure it.

Figure:5 Mower (a) Baler (b)

1. Rakes and Mergers

Hay and forage producers have a wide variety of equipment options for raking and merging swaths or windrows. Selecting the proper equipment and operating it correctly will insure high quality hay and forage with a cost effective harvesting system. Numerous studies have provided results on equipment performance and selection that fit specific forage harvesting systems.

Mergers

As forage harvesters have increased in capacity, the need for merging more swaths into a single windrow. **The major difference between the rakes and mergers** is that the mergers lifts the crop onto a belt conveyor that is used to move and deposit the swath into the desired location so the crop is never dragged along the ground. The merger can be used **for either silage or dry hay although its primary use is silage.**

Fig 6. Rakes and Mergers

Mergers

Tedding is an aggressive action and is acceptable for grasses where leaf loss is less of a concern. But for alfalfa there is concern that tedders will cause unacceptable leaf loss, especially if the tedding is done when the crop is partially dry and the leaves are brittle. Tedding adds an additional step in the hay making process: cutting, tedding, raking, and baling.

1. Milking machine

The principle of machine milking is to extract milk from the cow by vacuum. The machines are designed to apply a constant vacuum to the end of the teat to suck the milk out and convey it to a suitable container, and to give a periodic squeeze applied externally to the whole of the teat to maintain blood circulation.

A milking machine installation consists of a pipe work system linking various vessels and other components which together provide the flow paths for air and milk. The forces necessary to move air and milk through the system arise from the fact that it is maintained at a vacuum. Thus it is atmospheric pressure which forces air, and intra-mammary milk

pressure which forces milk, into the system and the combination of these forces causes flow. To be a continuous operation it is necessary to remove air and milk from the system at appropriate rates.

Parts of machine milking

Milking machines have now developed into systems that show considerable diversity they have the same basic components. The air is removed by a vacuum pump at a constant rate.

Fig. 1 shows the flow of air and milk through three basic types of machine during normal milking. In the bucket (or direct-to-can) machine the milk enters the teatcups and travels through the short milk tubes to the claw where air is admitted and the milk and air travel along the long milk tube to the bucket (or can). The milk remains in the bucket (or can) and the air separates to pass up the vacuum tube to the vacuum pipeline. The pulsator which is usually fixed on the bucket lid admits air intermittently and this passes along the long pulse tube to the teatcup chambers. To control the vacuum at a predetermined level air is also admitted to the system through a vacuum regulator which is fitted on the vacuum pipeline near to the milking points.

The machine includes teat cups that contact the cow's teats and remove the milk, a claw where milk pools as it is removed from the four teats, vacuum tubes that provide vacuum to the teat cups and a milk tube that removes milk away from the claw, a source of vacuum for the machine, and a pulsator that regulates the on-off cycle of the vacuum. Many milking machines today have an automatic take-off (ATO or detacher) device that removes the machine from the cow when milking is completed.

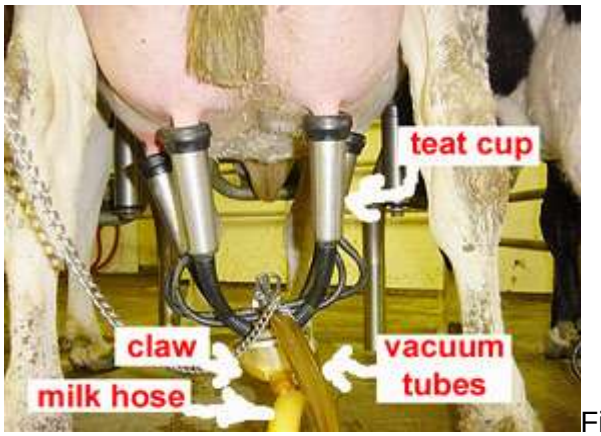


Fig 7. Milking machine

Fig.1. Milking *machine on a cow indicating machine parts. Note the chain leading from the claw to the left side of the image*.

Most cows have four functional teats. Therefore, milking machines are designed with four teat cups. These are composed of an inner rubber liner and an outer shell, usually made of metal. The rubber liner is relatively thin in the section that sits inside of the shell, while the liner's tube below the shell is thicker rubber.

1. Cream separator

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 maximize the efficiency of the separation process.

1. Gravity separation

Fat globules in milk are lighter than the plasma phase, and hence rise to form a cream layer.

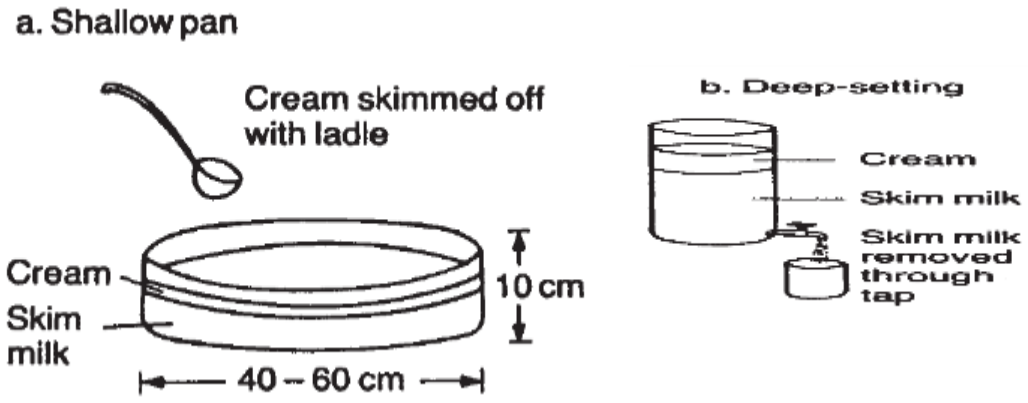


Fig 8. *Batch separation of milk by gravity: (a) Shallow pan method, (b) Deep-setting method.*

2. Centrifugal separation

- ✓ Gravity separation is slow and inefficient. Centrifugal separation is quicker and more efficient leaving less than 0.1% fat in the separated milk compared with 0.5--0.6% after gravity separation. It also allowed removal of cream and recovery of the skim milk in a fresh state.
- ✓ The separation of cream from milk in the centrifugal separator is based on the fact that when liquids of different specific gravities revolve around the same centre at the same distance with the same angular velocity, a greater centrifugal force is exerted on the heavier liquid than on the lighter one.

Operators should be responsible for their machines.

Operation of cream separator

1. When the bowl is set, fit the skim milk spout and the cream spout.

2. Fit the regulating chamber on top of the bowl.

3. Put the float in the regulating chamber.

4. Put the supply can in position, making sure that the tap is directly above and at the centre of the float.

5. Pour warm (body temperature) water into the supply can.

6. Turn the crank handle, increasing speed slowly until the operating speed is reached.

7. Open the tap and allow warm water to flow into the bowl. This rinses and heats the bowl, allows a smooth flow of milk and increases separation efficiency.

8. Pour warm milk (37--40°C) into the supply can. Repeat steps 6 and 7 above and collect the skim milk and cream separately.

9. When all the milk is used up and the flow of cream stops, pour about 3 litres of the separated milk into the supply can to recover residual cream trapped between the discs.

10. Continue turning the crank handle and flush the separator with warm water.

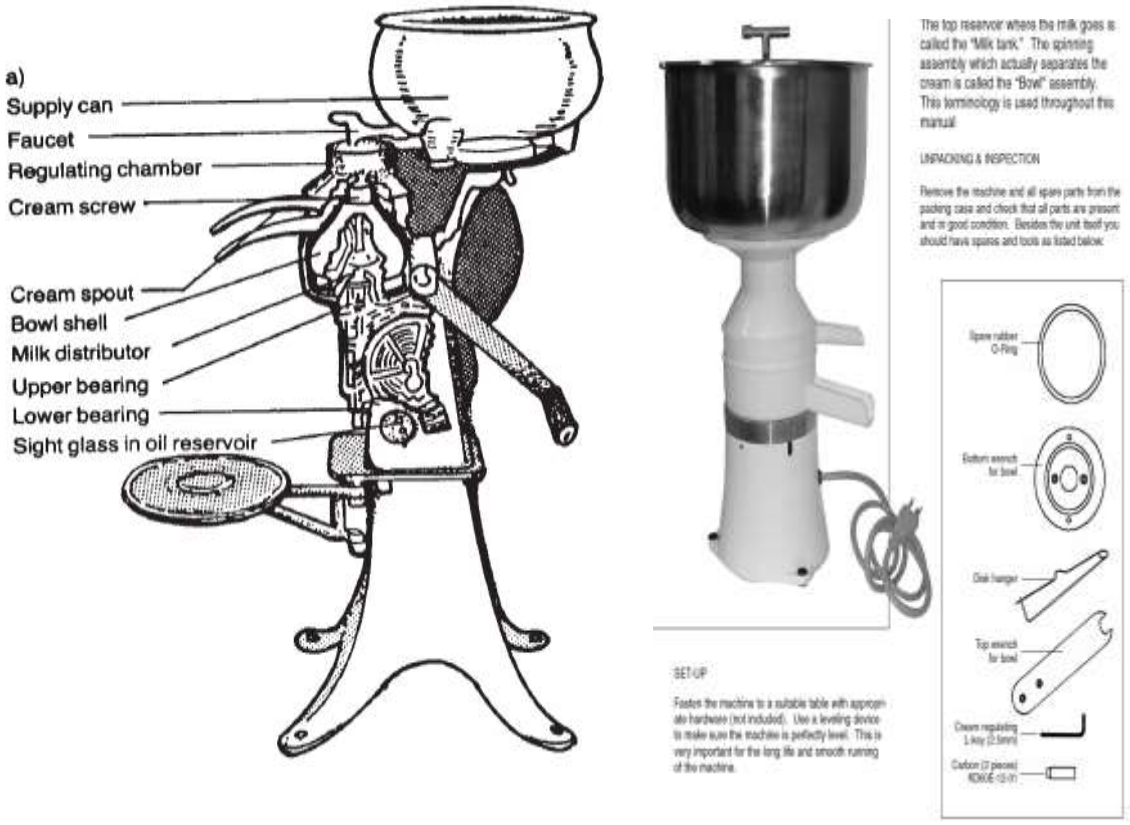
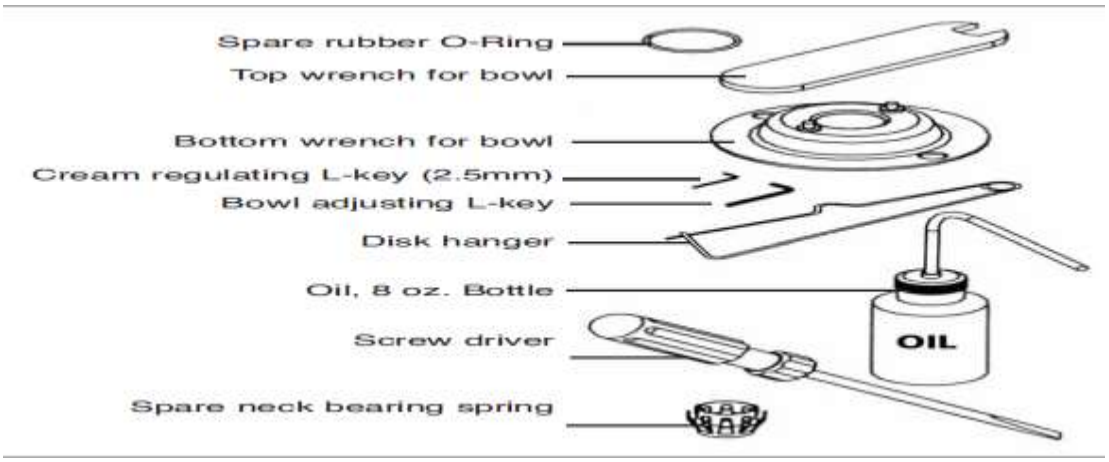


Fig 9. A).manual cream separator b). Electrical cream separator

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



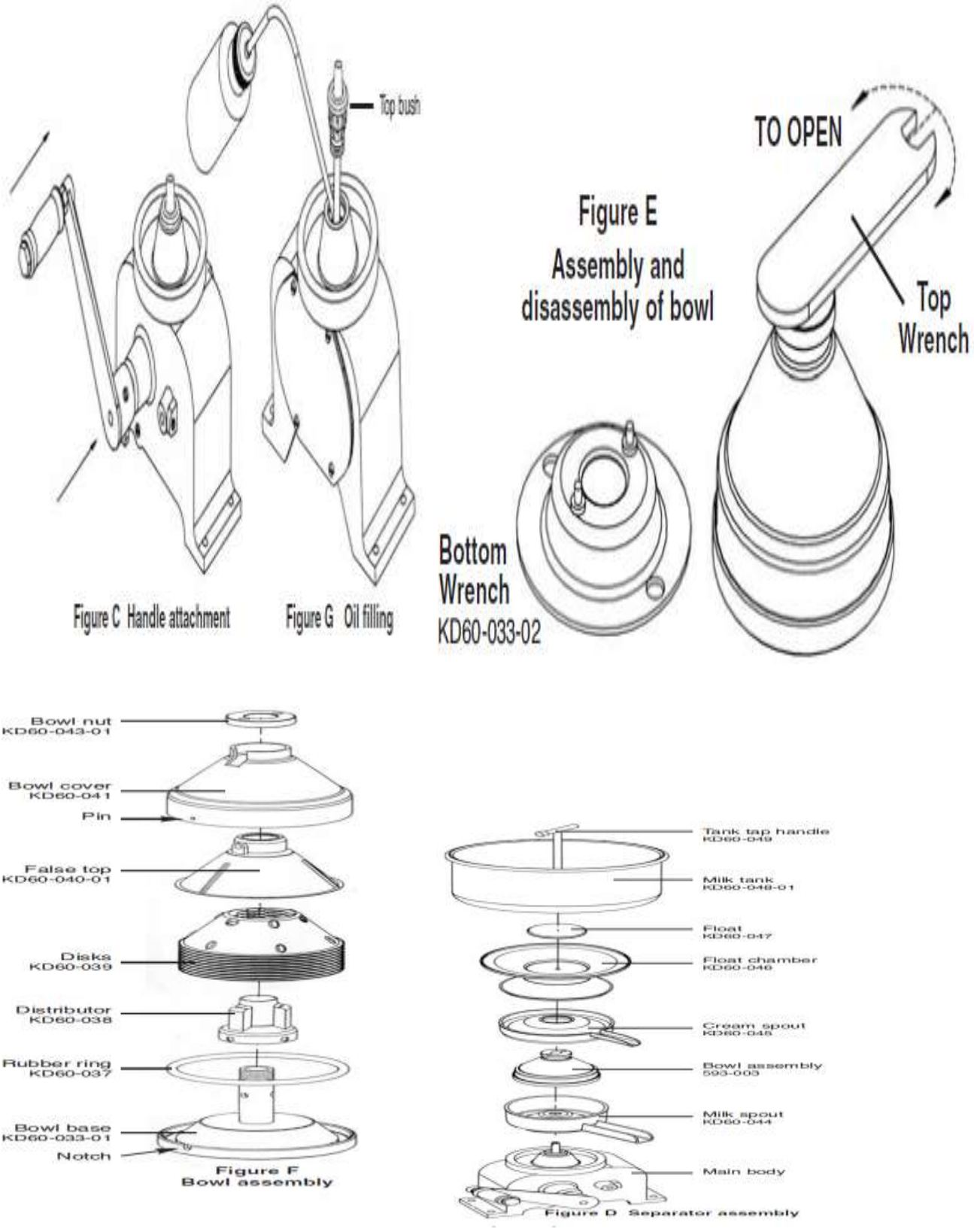


Fig 10. Spares and tools of cream separator

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.

Cleaning of milk contact parts

The bottom wrench should be bolted to your work table for ease of disassembly of the bowl. Dismantle and wash all parts in soap and warm water until thoroughly clean. Rinse well and wipe dry.

Assembly the cream separator

Put the bowl assembly back together. 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 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.

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.

2. Butter churn

A butter churn is a device used to convert cream into butter. This is done through a mechanical process, frequently via a pole inserted through the lid of the churn, or via a crank used to turn a rotating device inside the churn.

Process

The agitation of the cream, caused by the mechanical motion of the device, disrupts the milk fat. The membranes that surround the fats are broken down, subsequently forming clumps

known as butter grains. These butter grains, during the process of churning, fuse with each other and form larger fat globules. Air bubbles are introduced into these fat globules via the continued mechanical action of the churn. The butter grains become more dense as fat globules attach to them while the air is forced out of the mixture. This process creates a liquid known as buttermilk. With constant churning, the fat globules eventually form solid butter and separate from the buttermilk. The buttermilk is then drained off and the butter is squeezed to eliminate excess liquid and to form it into a solid mass.

Types of Butter Churns

The most historically prominent types of butter churns are the plunge churn, which is a container, usually made out of wood, where the butter-making action is created by moving in a vertical motion a staff that is inserted into the top. This type of churn is also known as an 'up and down' churn, churning tub, plunger churn, plumping churn, knocker churn, plump-kirn, or plowt-kirn.

One particularly novel invention of note was the rocking chair butter churn. This device, invented by Alfred Clark, consisted of a barrel attached to a rocking chair. While the rocking chair moved, the barrel moved and churned the milk within into butter.

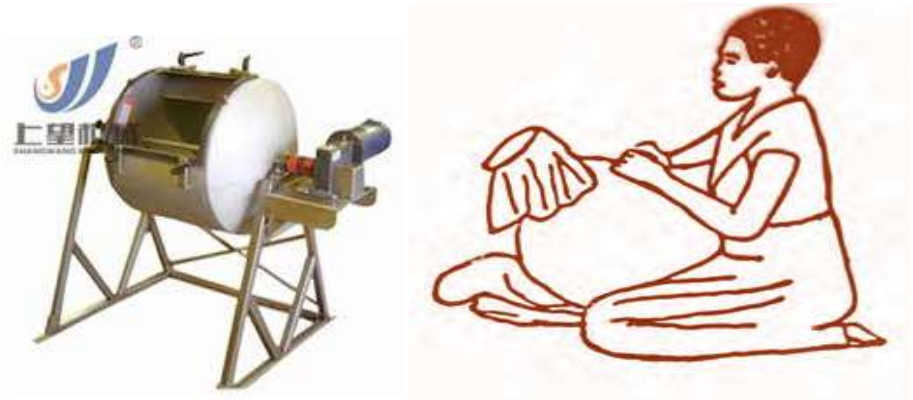


Fig. 11. A. Modern electric churner B. Traditional butter churning clay pot

Self-Check -1	Written Test

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

1. Define the following terms

A). Machinery

b).Equipments

c). Tools

d). Machine

e). Implement

2. What are the basic machinery and equipment required in dairy farm? List it

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1.a._____

_____

b._____

_____

c._____

_____

d._____

_____

e._____

2._____

Information Sheet-2	Confirming appropriate machine and equipments

2.1. Setting machinery

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

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

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

Self-Check -2	Written Test

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

1. During setting machinery one can be expected

A. Lighted dry place with plenty of room to work

B. Arrangement should be suitable c.

C. Related equipment may be grouped together.

D. Straight-line flow of product E. All

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

____

Information Sheet-3	Carrying out routine pre-operational checks of machinery and equipment

3.1. **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.

3.2. 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.

3.3. 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.

Engine oil level (not necessary with two-stroke motors)

- Check the engine oil level with the engine stopped and the mower on a level surface
- Clean the area around the oil filler cap
- Remove the oil filler cap, and wipe the dipstick clean
- Insert and remove the dipstick without screwing it into the filler neck. Check the oil level
- Shown on the dipstick
- If the oil level is low, add the recommended oil to reach the upper limit mark on the
- Dipstick - do not overfill • after checking the engine oil level, screw in the oil filler cap /
- Dipstick securely.

Fuel

- Do not smoke while re fuelling the mower
- Refuel in a well-ventilated area before starting the engine - if the engine has been running, allow it to cool
- Remove the fuel filler cap and check the fuel level
- If the fuel level is low, refill the tank with the correct type of fuel for the motor. Refuel
- Carefully to avoid spilling fuel - do not overfill
- After re fuelling, tighten the fuel filler cap securely as petrol is highly flammable and
- Explosive
- Never refuel the mower inside a building where petrol fumes may reach flames or sparks
- Keep petrol away from appliances with pilot lights, barbecues, electric appliances, etc.
- Fuel can damage paint and plastic, be careful not to spill fuel when filling your fuel tank.

Air Cleaner

- Make sure the air filters are clean and in good condition
- A dirty air filter will restrict air flow to the carburetor, reducing engine performance.
- Grass catcher

- If you are not sure what cutting height to select, start with a high setting and check the appearance of the lawn after mowing a small area, then re-adjust cutting height if necessary.

Six routines must be followed in order to minimize the chances of your hydraulic equipment suffering costly, premature component failures and unscheduled downtime:

- Maintain fluid cleanliness;
- Maintain fluid temperature and viscosity within optimum limits;
- Maintain hydraulic system settings to manufacturers' specifications;
- Schedule component change-outs before they fail;
- Follow correct commissioning procedures; and
- Conduct failure analysis.

Self-Check -3	Written Test

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

1. The mechanical defects checks include

A. Brakes, B. Wheels and C. Tyres. D. All

2. List routine checks before starting any work with a machine, including operation, maintenance or repair.

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

_____

_____

2._____

_____

_____

_____

_____

_____

_____

Information Sheet-4	Carrying out manufacturers specifications and enterprise requirements

4.1. Importance of following manufacturer's specifications and enterprise requirements

The things which go wrong with equipment can often be easily solved by reference to the manufacturer's instruction manual. It is very unfortunate if equipment is unsatisfactory when a simple adjustment as explained in the instructions manual would solve the problem. Most manufacturers of dairy equipment furnish complete instructions that show exactly how the equipment is to be operated, especially on major items of the equipment e.g. cream separator, churner, pasteurizer, refrigeration machine, Ice Cream Freezer, homogenizer etc.

Most breakages of machinery and loss of efficiency, together with unsatisfactory operation can be traced from failure to follow the manufacturer's instructions. It is impossible for busy superintendent to carry around all detailed instructions for all his machineries. It is therefore important at all times that the instructions be available to the man who operates the machine. The superintendent/supervisor should occasionally check them over with the operator to make certain that the operator has absorbed the information in the instruction book.

4.2. **Enterprise requirements**

Enterprise requirements may include SOPs (Standard Operating Procedure), industry standards, production schedules, MSDSs (Material Safety Data Sheets), work notes, product labels, manufacturers specifications, operators manuals, enterprise policies and procedures (including waste disposal, recycling and re-use guidelines), OHS procedures, supervisors oral or written instructions, work and routine maintenance plans.

Self-Check -4	Written Test

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

1. Which one of the following are major items of the equipment in dairy

A. cream separator B. churner C. pasteurizer D. refrigeration machine E. Homogenizer F. All

2. Most breakages of machinery and loss of efficiency, together with unsatisfactory operation can be traced from failure to follow the manufacturer's instructions

A. True B.False

3. Which one are contents of enterprise requirements

A. Standard Operating Procedure B. Industry standards and manufacturers specifications

C. Production schedules and product labels D. Material Safety Data Sheets E. All

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 2 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1_____**2**_____**3**_____

Information Sheet-5	Attaching and calibrating equipment securely for operation

5. 1. Calibrating equipment for operation

Calibration is defined as an association between measurements – one of a scale or accuracy made or set with one piece of equipment and another measurement made in as similar a way as possible with a second piece of equipment. The piece of equipment or device with the known or assigned accuracy is called the standard.

Standards vary from country to country depending upon the type of industry even as manufacturers designate their measurement criterion and recommend the frequency and level of calibration, depending upon industry requirements, how often the device is used and the specific application.

Importance of Calibration

It defines the accuracy and quality of measurements recorded using a piece of equipment.

The goal of calibration is to minimize any measurement uncertainty by ensuring the accuracy of test equipment. Calibration quantifies and controls errors or uncertainties within measurement processes to an acceptable level.

When towing/calibrating implements

- Fit attachments according to the manufacturer& instructions
- Always attach implements to the draw bar or the mounting points provided by the manufacturer.
- Never alter, modify or raise the height of the draw bar unless provided for by the
- Manufacturer.
- Regularly check safety pins on towed lift-wing implements, to ensure they are not worn.
- Ensure all guards on towed implements are in place before operating.
- Never hitch above the centerline of the rear axle, around the axle housing or to the top link pin.

- Never adjust or work on implements while they are in motion.
- Never attach implements unless the PTO shaft is guarded.

When parking, always lower the three-point linkage and towed implement

5.2. Hitching/attaching Implements

Implements are agricultural equipment that are attached or connected on the agricultural machineries in accordance with their specific performance. E.g. Plough, harrow, planter, etc

Implements are grouped into two:-

1. Mounted implements and

2. Trailed implements

1. Mounted implements: are implements that can be held by the machinery with three point linkage attachment. They can be hanged up by the machineries and do not have wheels.

2. Trailed implements: are implements that are not mounted in three point linkage but are pulled by the machineries with the help of the draw bar and wheeled by the wheels and bearing of the rotary parts. They cannot be hanged up because they have only two points linkage. The draw bar linkage point and the side bar linkage point. The draw bar linkage is used to trail or pull the implements and the side bar linkage is used to prevent side way tilting of the implement.

Different implements are used for different duties. Most of the time trailed implements are used for land preparation duties, and mounted implements are used for cultivation duties.

Hitching/attaching Implements

People have been killed or seriously injured during hitching operations.

Observe the following points while hitching your tractor to implements:

- Make sure that the area is clear and no one is behind the tractor
- Back the tractor up slowly to the implement
- Stop and apply the emergency brake
- Put the transmission in neutral

- Dismount the tractor and hitch up
- If you have someone assisting you in hitching an implement:
- make sure your helper stands clear while you back up the tractor
- back up a little more than necessary and stop the tractor
- put the tractor in a forward gear, then allow the helper behind it
- Inch the tractor forward while your assistant drops in the draw pin Three point linkage
- knobs

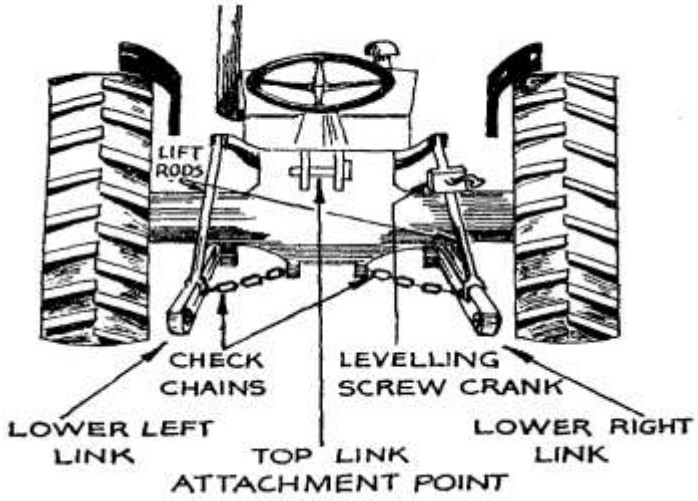


Fig:12. Hitching points behind the Tractor

Self-Check -5	Written Test

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

1. The piece of equipment or device with the known or assigned accuracy is

A. Standard B. Calibration C. Hitching/attaching D. All

2. Which one of the following are implements

A. Plough B. harrows C. planter D. All

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1_____**2**_____

Information Sheet-6	Identifying, safety tagging, and reporting faulty machinery and equipment

6.1. Identifying and safety tagging machinery and equipment

Any piece of equipment (including tools and furniture) identified as unsafe, either in normal day-to-day activities or during a safety inspection, Equipment identified as faulty should be disconnected and tagged, and appropriate service

People contacted to arrange repair or replacement. With faulty equipment under no circumstances is any sort of repair to be undertaken by the Workers. Only authorized technicians specifically trained to service the equipment must deal with the repairs.

Clear signage alerting other users to the danger must be posted in clearly visible locations.

The following thing you consider for identifying safety work of equipment;

Think, plan and check

- Lockout procedure must be employed whenever a piece of equipment is being repaired and
- There is the possibility of that equipment being switched on without the knowledge of the repairer.
- Identify all parts of any equipment or system that needs to be shut down.
- Find the switches, valves or other devices that need to be switched off.
- Follow the correct procedure for the shutdown of equipment so you don't endanger anyone.

Communicate

- Tell all staff potentially affected by the tag out of that piece of equipment that this item is not to be used and why.
- Verify all equipment located
- Make sure all personnel are informed of any potential danger.
- Verify that the main disconnect switch or circuit breaker cannot be accidentally turned on.
- Turn all controls to OFF

Removal of the tag out tag and lockout device

- The tag out tag and lockout device (where applicable) can be removed only after all repair work has been completed and a service report received stating that the equipment is safe to be used again.
- Only an authorized person who has been directly notified of the repairs by the service person should remove the tag out tag and lockout device.

Notify all users of the equipment that the tag out tag has been removed.

- It is the responsibility of all staff to take immediate action upon the identification of any piece of equipment that may be hazardous or faulty.
- Unsafe equipment should be reported by the staff member to their supervisor.

6.2. Report writing on Unsafe or faulty machinery and equipment

In machine world, there are the following defects

- Failure: unintentional damage
- Workmanship: unskilled person
- Design: not fitting actual requirement
- Material: failure at handling
- Operation: mal-operation

The following can occur through the above; the failures should be identified what type of failure what part of the machine or equipment is failed should be reported.

The failures can be occur due to corrosion, fatigue, failure or wear

1. **Fatigue failure**: when fluctuating loads are applied a crack developed
2. **Corrosion**: corrosion is used to describe an unintentional chemical reaction between a material and its environment
3. **Wear**: is progressive loss of material from surface as a result of sliding or rolling contacts between surfaces or from the movement of fluids containing practices over surface.

Self-Check -6	Written Test

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

1. List defects in machine world.
2. The failures in machinery can be occur due to _____, _____ and_____

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

_____

2._____

Information Sheet-7	Identifying OHS hazards in workplace

7.1. 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.

- Physical Hazards
- Ergonomic Hazards

- Chemical Hazards
- Biological Hazards

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.

Self-Check -7	Written Test

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

1. Write four common types of hazards you should be aware of at work.

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

_____

Information Sheet-8	Assessing and reporting risk

8.1. Assessing Occupational Health and Safety hazards in workplace

Open communication and reporting on the implementation of the risk assessment and the measures taken on the basis of the assessment are all important factors in getting the entire staff to commit to the development of a safe and healthy workplace.

The six main categories of hazards are:

- Biological. Biological hazards include viruses, bacteria, insects, animals, etc., that can cause adverse health impacts.
- Chemical. Chemical hazards are hazardous substances that can cause harm.
- Physical.
- Safety.
- Ergonomic.
- Psychosocial.

8.2. Reporting Occupational Health and Safety hazards in workplace

Acute hazards should always be reported immediately to a supervisor, delegated Workplace Health and Safety officer or representative.

Hazards in the workplace may be reported in a number of ways:

1. A verbal report to a supervisor.
2. Completing a Hazard Report form.
3. Raising the issue at a staff meeting

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.

Self-Check -8	Written Test

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

1. List potential hazards related with machinery in work place

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

_____

_____

Operation Sheet 1	Operation of cream separator

Steps Operation of cream separator

1. When the bowl is set, fit the skim milk spout and the cream spout.

2. Fit the regulating chamber on top of the bowl.

3. Put the float in the regulating chamber.

4. Put the supply can in position, making sure that the tap is directly above and at the centre of the float.

5. Pour warm (body temperature) water into the supply can.

6. Turn the crank handle, increasing speed slowly until the operating speed is reached.

7. Open the tap and allow warm water to flow into the bowl. This rinses and heats the bowl, allows a smooth flow of milk and increases separation efficiency.

8. Pour warm milk (37--40°C) into the supply can. Repeat steps 6 and 7 above and collect the skim milk and cream separately.

9. When all the milk is used up and the flow of cream stops, pour about 3 litres of the separated milk into the supply can to recover residual cream trapped between the discs.

10. Continue turning the crank handle and flush the separator with warm water

Operation Sheet 2	Assemble the bowl the cream separator

Procedures for assembling the bowl of the cream separator

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 4 hour.

Task 1. Operate of cream separator

Task 2. Assemble the bowl the cream separator

Reference Materials

1. IDF. 1990 Hand book of Milk Collection in Warm Developing Countries. IDF Special Issue 9002

2. Tractor-Implement Systems" by Ralph Alcock

3. Handbook of Farm, Dairy and Food Machinery Paperback – 19 Oct 2010 by Myer Kutz (Author)

DAIRY PRODUCTION

Level II

Learning Guide -57

Unit of Competence: - Assist in Dairy Machinery and Equipment Operation

Module Title: - Assisting in Dairy Machinery and Equipment Operation

LG Code: AGR DRP2 M15 LO2-LG-57

TTLM Code: AGR DRP2 TTLM 1219v1

LO2:- Operate machinery and equipment

Instruction Sheet	Learning Guide 57

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

- Operating machinery and equipment in a safe and controlled manner.
- Recognizing and minimizing risk to self, environment and the others.
- Selecting suitable personal protective clothing and equipment
- Identifying and assessing environmental implications
- Reporting environmental implications

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.
- Recognize and minimize risk to self, environment and the others.
- Select suitable personal protective clothing and equipment.
- Identify and assess environmental implications
- Report environmental implications

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 Sheets 1,2,3,4 and 5” in page 2,6,9,13 and 15 respectively. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1,2,3,4 and 5” **in page -.** ,5,8,12,14 and 16.
5. 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).

6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.

Information Sheet-1	Operating machinery and equipment in a safe and controlled manner

1.1. Operating machinery and equipment in a safe and controlled manner

All organizations should have “safe operating procedures” (SOP’s) for all machinery and equipment operated by them. SOP’s for machinery help make sure that machines are operated safely and should cover:

- Warnings
- PPE signage
- Pre-operational safety checks
- Operational safety checks
- Stopping procedures
- Housekeeping
- Potential hazards.

The safe place to work

Work in agricultural mechanics involves extensive contact with tools and machinery. Therefore workers should be especially aware of the hazards that exist and take special precautions as needed.

Estimating Operating Costs

Operating costs, unlike fixed costs, change in proportion to hours of operation or use. They depend upon a variety of factors, many of which are, to some extent, under the control of the operator or equipment owner.

1.2. Maintenance and Repair

This category includes everything from simple maintenance to the periodic overhaul of engine, transmission, clutch, brakes and other major equipment components, for which wear primarily occurs on a basis proportional to use. Operator use or abuse of equipment, the severity of the working conditions, maintenance and repair policies, and the basic equipment design and quality all affect maintenance and repair costs.

Fuel:-The fuel consumption rate for a piece of equipment depends on the engine size, load factor, the condition of the equipment, operator habit, environmental conditions, and the basic design of equipment.

To determine the hourly fuel cost, the total fuel cost is divided by the productive time of the equipment. If fuel consumption records are not available, the following formula can be used to estimate liters of fuel used per machine hour,

$$LMPH = \frac{K \times GHP \times LF}{KPL}$$

Where LMPH is the liters used per machine hour, K is the kg of fuel used per brake hp/hour, GHP is the gross engine horsepower at governed engine rpm, LF is the load factor in percent, and KPL is the weight of fuel in kg/liter. Typical values are given in Table 3.3. The load factor is the ratio of the average horsepower used to gross horsepower available at the flywheel.

Table 1. Weights, fuel consumption rates, and load factors for diesel and gasoline engines**.**

Engine	**Weight(KPL) kg/liter**	**Fuel Consumption(K) kg/brake hp-hour**	**Load Factor (LF)**		
			Low	**Med**	**High**
Gasoline	0.72	0.21	0.38	0.54	0.70
Diesel	0.84	0.17	0.38	0.54	0.70

Variable Effort Cycles

The concept that men or equipment work at constant rates is an abstraction that facilitates measurements, record keeping, payments and analysis.

If a single machine rate were used to estimate the unit cost for truck transport and this value was converted to a ton-km cost or $/m3-km cost without removing the "fixed" cost of loading and unloading then the "variable" cost of transport would be overestimated. This could lead to erroneous results when choosing between road standards or haul routes.

Animal Rates

The calculation of the animal rate is similar to the machine rate, but the types of costs differ and merit additional discussion.

Fixed Cost

The fixed cost includes the investment cost of the animal or team, harness, yoke, cart, logging chains and any other investments with a life more than one year. Other fixed costs include the upkeep of the animals.

The purchase price of the animal may include spare animals if the working conditions require that the animal receive rest more than overnight, such as every other day.

Animal support costs which do not vary directly with hours worked include pasture rental, food supplements, medicine, vaccinations, veterinarian services, shoes, ferrier services and any after-hours care such as feeding, washing or guarding. It could be argued that food and care requirements are related to hours worked and some part of these costs could be included in operating costs. Pasture area (ha/animal) can be estimated by dividing the animal consumption rate (kg/animal/month) by the forage production rate (kg/ha/month). Food supplements, medicine, vaccinations, and veterinarian schedules can be obtained from local sources such as agricultural extension agents.

Operating Costs

Operating costs include repair and maintenance costs for harnesses, carts, and miscellaneous equipment.

Labor Costs

The labor cost in the animal rate is for the animal driver (and any helpers). For full year operations it is calculated as the labor cost per year including social costs divided by the average number of working days or hours for the driver (and any helpers).

Self-Check -1	Written Test

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

1. List contents safe operating procedures

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

_____

_____

_____

_____

_____

Information Sheet-2	**Recognizing and minimizing risk to self, environment and the others**

2.1. Potential risks and hazards associated with the operation of machinery and equipment

Some of the potential existing risks that may affect working efficiency of machinery include**:**

- Being kept in poor conditions
- Poorly designed or ill-fitting harnesses, saddles and yokes
- Pulling un-roadworthy or overloaded carts (or other loads)
- Lack of shade
- Working long hours with little rest
- 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.

To minimize the risk and hazard

- Using of relevant protective clothing and equipment,
- Use of tooling and equipment,
- Workplace environment and safety handling of material,
- First aid kit
- Hazard control and hazardous materials and substances.
- Using gowns, rubber boots of appropriate size, goggles, gloves etc,

➢ **Apply safe operating procedures regarding:**

- Electrical safety,
- Machinery movement and operation,
- Working in proximity to others and site visitors.

➢ **Apply emergency procedures:**

- Emergency shutdown and stopping of equipment,
- First aid application and site evacuation. electrical safety,
- Machinery movement and operation

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. Some of the potential existing risks that may affect working efficiency of machinery.

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

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2._____

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Information Sheet-3	Selecting suitable personal protective clothing and 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.

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

3.2. 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.

3.3. 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.

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

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Information Sheet-4	Identifying and assessing environmental implications

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.

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).

Self-Check -4	Written Test

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

1. What are environmental implication related with dairy farm machinery and equipments?

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

Answer Sheet

Score = _____

Name: _____ Date: Rating: _____

Short Answer Questions

1_____

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Information Sheet-5	Reporting environmental implications

Environmental implications may be

- 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.

Self-Check -5	Written Test

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

1. Source of Negative environmental impacts.

Note: **Satisfactory rating - 5 points** **Unsatisfactory – below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

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Reference

1. IDF. 1990 Hand book of Milk Collection in Warm Developing Countries. IDF Special Issue 9002

DAIRY PRODUCTION

Level II

Learning Guide- 58

Unit of Competence: - Assist in Dairy Farm Machinery and Equipment Operation

Module Title: - Assisting in Dairy Farm Machinery and Equipment Operation

LG Code: **AGR DRP2 M15 LO03-LG-58**

TTLM Code: **AGR DRP2 TTLM 1219v1**

LO3:- Check and complete machinery and equipment operation

Instruction Sheet	Learning Guide #58

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

- Carrying out machinery and equipment shut-down procedures.
- Maintaining machinery and equipment operational records.
- Recording and/or reporting machinery and equipment damage, malfunctions or irregular performance
- Cleaning, securing and storing 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 –

- Carry out machinery and equipment shut-down procedures.
- Maintain machinery and equipment operational records.
- Record and/or reporting machinery and equipment damage, malfunctions or irregular performance
- Clean, secure and store machinery and equipment.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 1to 7.
3. Read the information written in the “Information Sheets 1,2,3 and 4” in 3, 5,7 and 10respectively. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.

4. Accomplish the “Self-check 1,2,3, and 4 ” **in page -.** 4,6,9, and 13.
5. 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).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.

Information Sheet-1	Carrying out machinery and equipment shut-down procedures

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/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.

Self-Check -1	Written Test

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

1. General requirements for shut down.

Note: **Satisfactory rating - 5 points** **Unsatisfactory – below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

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Information Sheet-2	Maintaining Operational Records of Machinery and Equipment

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.

2.2. Maintaining self-propelled equipment

- Check or drain, flush and refill the radiator with correct coolant.
- Drain engine oil and analyze it to determine the presence of contaminants.
- Check hydraulic system fluid. Replace if needed.
- Check the transmission fluid level. If needed, drain and refill. Install new filters.
- Check fuel tanks for condensation. Fill tanks with high-grade fuel.
- Disconnect battery ground cables if the machine is idle for several months.
- Check fire pressure frequently during the winter.

Self-Check -1	Written Test

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

1. Put methods of maintaining self-propelled equipment

Note: **Satisfactory rating - 5 points** **Unsatisfactory – below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

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Information Sheet-3	Recording and/or Reporting Damage, Malfunctions or Irregular Performance of 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.

3.2.1. 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. list simple steps of maintenance management?

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

Answer Sheet

Name: _____ Date: _____

Score = _____

Rating: _____

Short Answer Questions

1._____

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Information Sheet-4	Cleaning, securing and storing 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

a) 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.

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

1. Change engine oil and replace oil filter, used oil will not give adequate protection
2. Service air cleaner
3. Draining and flushing cooling system is recommended and refill with the appropriate coolant.
4. Remove V-belts of fan/alternator
5. Remove and clean batteries, store them in a cool dry place and keep them fully charged
6. Disengage the clutch for any drive line
7. Clean the exterior of the engine with salt free water and paint any scratched or chipped painted surfaces
8. Coat all exposed metal surfaces with grease or corrosion inhibitor if not feasible to point.
9. Seal all openings on engine with plastic bags and tape

10. 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

1. Clean the entire parts with salt free water
2. Paint or grease parts that are exposed for corrosion
3. 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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2_____

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3_____

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Reference

1. **IDF. 1990 Handbook of Milk Collection in Warm Developing Countries. IDF Special Issue 9002**
2. **Dairy Processing Plant and Equipment Considerations by Eric Goan**

Trainers prepared the TTLM with their full address

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