Meat & Meat Products Processing Level –III

Based on October 2019, version 1

Occupational standards

Module Title: Setting up a Production or Packaging Line for Operation

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Contents

LG # 73	LO 1: Prepare for line setup

Instruction sheet

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

- Confirming materials and available
- Confirming equipment and related accessories
- Availing tools and equipment required for line setup, operational and fitting.
- Identifying processing parameters and settings

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

- Confirm materials and available
- Confirm equipment and related accessories
- Avail tools and equipment required for line setup, operational and fitting.

Identify processing parameters and settings

Learning Instructions:

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

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

Information sheet 1 Confirming materials and available

1.1. Introduction

The Meat-Processing Industry

The meat-processing industry consists of establishments primarily engaged in the slaughtering of different animal species, such as cattle, hogs, sheep, lambs, or calves, for obtaining meat to be sold or to be used on the same premises for different purposes. Processing meat involves slaughtering animals, cutting the meat, inspecting it to ensure that it is safe for consumption, packaging it, processing it into other products such as sausage or lunch meats, delivering it to stores, and selling it to customers.

The meat-processing industry is a separate entity from the meat-packing industry: Processing involves taking the meat in its raw form and turning it into another product that is marketable, safe for consumption, and attractive to consumers. Packaging is often an important part of the meat-processing industry, because processed meats often take on forms that are not natural shapes.

The design problem is to establish and specify the mix of operations (i.e., machines) and material requirements, which, with appropriate scheduling, can produce defined quantities of the required products with assured quality and form.

1.2. Some of the materials used in production or packaging line

- Water availability for showering processes and others
- Access and availability of electric supply
- Cooker and chiller availability and functionality
- Casing filling material
- Weighing scale/sensitive balance
- Deboning area and materials
- Different size Knives (cooking knife, curving knife, utility knife, filleting knife, boning knife, shaping knife, pleating knife, meat cleaver knife, breast knife, turning knife, kitchen knife)

- Apron
- Personal protective equipment
- Packaging materials
- Sanitation and hygienic materials
- Deboning and cutting table
- Holding create
- hanging hooks
- cart
- grinder
- Mesh glove
- Tanks and pans
- Digital thermometers
- Safety materials availability
- First aid kits
- Forks /spoon
- Screw drive
- Shoe drier
- Air shower for removal of dusts
- Fire extinguisher and etc. should be available and confirmed

Self-Check -1	Written Test

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

1. Mention at least five materials and related accessories to be availed in the production line setup?(5pts)
2. Describe at least three knife types used in meat processing.(3pts)

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

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

Answer Sheet

Score = _____

Name: _____ Rating: _____ Date _____

1.
   - _____
   - _____

2.

   _____
   - _____
   - _____
   - _____

Information sheet 2- Confirming equipment and related accessories

As the name and functions of different equipment mentioned in the previous task the availability of materials, equipment and machineries are not the final goal for the processing activities. So it is important to check and confirm the functionality of the equipment and proper installation of machines

2.1. Equipment used in meat processing:

In modern meat processing, most of the processing steps can be mechanized. The major items of meat processing equipment needed to fabricate the most commonly known meat products are listed and briefly described hereunder.

2.1.1. Meat grinder (mincer)

- A meat grinder is a machine used to force meat or meat trimmings by means of a feeding worm (auger) under pressure through a horizontally mounted cylinder (barrel).
- A cutting system consisting of star-shaped knives rotating with the feeding worm and stationary perforated discs (grinding plates).
- If frozen meat and meat rich in connective tissue is to be minced to small particles, it should be minced first through a coarse disc followed by a second operation to the desired size.

2.2. Two different cutting system

A. Bowl cutter (bowl chopper):

- Meat chopping equipment designed to produce small or very small lean meat and fat particles. Consists of horizontally revolving bowl, curved knives rotating vertically on horizontal axle at high speed up to 500rpm.
- Equipped with strong cover which protects against accidents and design plays crucial role in the efficient of the chopping process by routing the mixture flow.
- Equipped with thermometer.
- Modern large scale operate under vacuum, helps to improve color and texture by keeping oxygen out of meat mixes and avoid air pockets.

B. piston stuffer:

- Used for filling all types of meat batter in casings, glass jars, Cans, etc.
- A piston is moved inside a cylinder forcing the meat through the filling nozzle into the containers.
- Sometimes simple hand-held funnels are used to push meat mixes into casings.
- Modern filling machine for large operation designed as continuous vacuum stuffers, enclosed air is removed from the product, improve color and texture of finished product.

2.2.1. Clipping machine

- Small aluminum sealing clips the sausage ends.
- Casing brakes slow release the shirred casings from filling horns ensuring tight filling. Then filled casing segment are clipped in portions.
- Generally used in large operation and mostly operated by compressed air.
- For medium-scale, manually operated hand clippers are used.

2.2.2. Smokehouses

- Tradition and small –scale operation:
- Burning damp hardwood sawdust, heating sawdust or log, etc. Modern smoke generation
- Burning/smoldering of saw dust
- Smoke generation through friction
- Smoke generation through steam

2.2.3. Combined equipment:

Modern facilities can combine smoking, cooking and cooling operations and continuous process. Parameter: Temperature up to 100 ºC and RH up to 100%. Refrigerated Units: as fermenting/ripening room for first crucial steps in production of fermented sausages/ram ham products (air temperature and air humidity accurately controlled).

2.2.4. Brine injector

- Serve for injection of brine into meat.
- Brine is water containing dissolved salt and curing substance as well as additives such as phosphates, spices, sugar, soya protein, etc.
- Injection is done by introducing pointed needless into the muscle tissue.
- Brine injection mainly used for various types of ham, bacon and whole muscle products. Brine injector should be cleaned and disinfected regularly.
- Before the injector is used, again all holes and needles should be rinsed with warm water to avoid blockage of needle hole.

2.2.5. Tumbler/massager

- Rotating drum with steel paddles inside slowly moves meat causing mechanical massaging effect.
- Salt and phosphates are added to achieve equal brine distribution and liberates protein extraction.
- Tumbler temperature below 10ºC to avoid microbial growth
- Tumbler temperature below -1º C, best temperature to extract soluble protein from muscle meat.

2.2.6. Vacuum packaging machine

- Meat product placed in vacuum bag.
- Air is removed from bag by vacuum packaging machine and sealed.
- Mixture of gas is injected evacuating the air, inhibit bacterial growth, and stabilize the meat color.
- Gas used are CO2 and N2.

2.2.7. Mixer/blender

- To blend meat and spices, or coarse and finely chopped meat.
- Consists of parallel shafts
- Various paddles mounted in shaft to mix meat.

- Discharged through tilting by 90 degree the meat.
- Vacuum mixer are also use to mix under vacuum, helps in development of desirable product color and texture.

2.2.8. Emulsifying machine:

- For very fine meat emulsion.
- Functional parts are perforated plate, attached to which two edged blades are rotating. Centrifugal pump forces pre-ground meat through perforated plane
- Emulsifier operates at higher speed then bowl cutter, produce finer emulsion-like mix.

2.2.9. Frozen meat cutter:

It makes frozen meat suitable for immediate comminuting in grinders, bowl cutter, etc. without previous thawing.

2.3. Two types of machine used either

A. With knives cutting in vertical direction or

B. Using rotating drums with attached sharp knives. Hardest frozen product can be cut by knives cutting in vertical direction.

1. Unfreezing Frozen Beef (Unfreezing Tank)

Figure 1. Unfreezing tank

2. Sorting (Stainless Steel Sorting Table)

Figure 2. Sorting table

3 Sousing & Pickling

Figure 3. Frozen meat cutting machine

		
Figure 4.primary treatment machine	Figure 5. ice generator	Figure .6 heat treatment machine
		
Figure .7 conveyor lines for deb-oning	Figure 8. Injecting machine	Figure . 9. Grinding /skinning machine

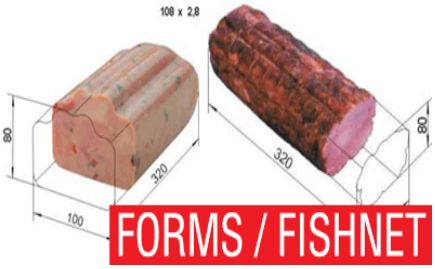
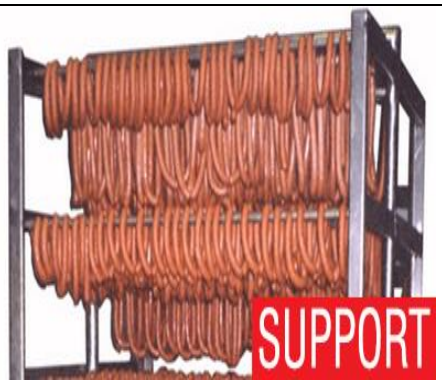
		
Figure 10. washing machine	Figure.11 meat smoking chamber	Figure12. smoking and ripening chamber
		
Figure 13. minced meat mixer	Figure 14 forms/fishnet	Figure15 commercial meat injector
		
Figure 16. Meat processing machines and plants	Figure 17. support	Figure18. Shrink packaging

		
Figure. 19 Shoe drier (accessory)	Figure.20 Hygiene station(accessory)	Figure 21 sterilizer(accessory)

2.4. Facility and Equipment Capabilities

- Can the plant appropriately handle the material (e.g., is sufficient storage capacity and special equipment or preparation available)?
- Is the existing equipment capable of handling the material (e.g. Granulation is too large for the dispenser)?

Self-Check -2	Written Test

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

1. Mention the functions of five equipment with their names.(5pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____Date _____

1

- _____ _____
- _____
- _____
- _____
- _____

Information sheet-3 Availing tools and equipment required for line setup, operational and fitting

3.1. Introduction

A production line is a set of sequential operations established in a factory where components are assembled to make a finished article or where materials are put through a refining process to produce an end-product that is suitable for onward consumption.

A production line involves the movement of products that are manufactured in a linear process. This means that a product moves progressively from start to finish in a sequential manner. Food processing uses production lines to move from raw materials to packaged goods

When considering the setting up of a meat and meat product processing plant, whether it be a cottage industry or a small industrial scale system, the first point to bear in mind is the infrastructure required to properly lodge all of the necessary equipment.

Sometime must thus be devoted to coordinate two aspects that are vital to the development of a project of this nature, namely costs and the quality of the infrastructure needed to achieve the established goals.

It must always be borne in mind that since the meat to be processed is intended for human consumption, the infrastructure must meet several requirements. The basic general aspects of such requirements will be analyzed in this information sheet.

The infrastructure comprises different aspects of a project's implementation. Issues like physical layout, basic services or installations and equipment must thus be taken into account.

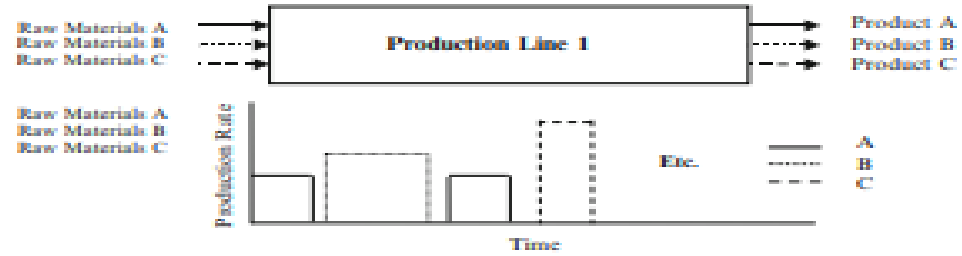
3.2 Physical layout

The physical layout of a plan of this nature may be very important to be considered in the first place.

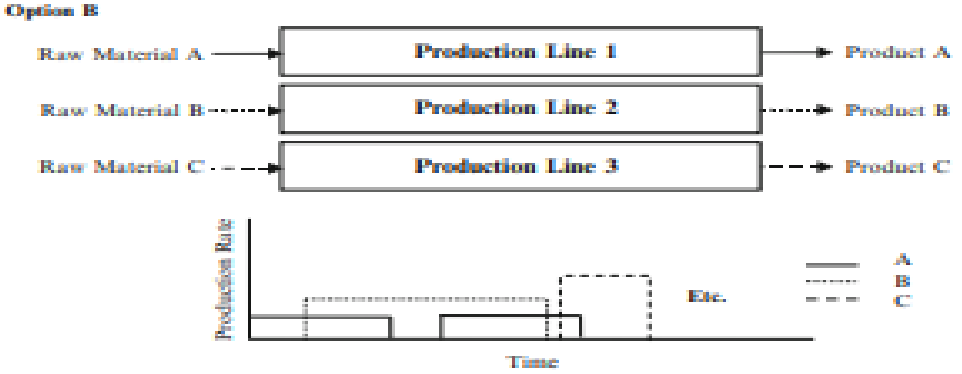
3.3 Production sites

Several different processes take place on the site where the production activity is performed, from the reception and conservation of raw materials, to the storage of finished products.

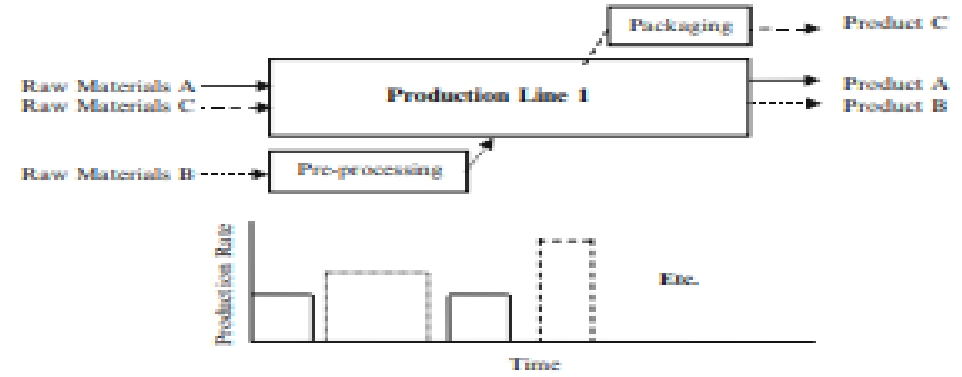
Option A



Option B



Option C



The materials, tools and equipment confirmed for its availability mentioned in the above information sheet I and II should be available for the line set up.

Self-Check -3	Written Test

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

1. Mention different aspects/issues that the infrastructure comprises in a project's implementation (5pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1.

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- _____
- _____

Information sheet-4. Identifying processing parameters and settings

The processing line and parameter which is set above should depend up on the objective of the enterprise in an enviromental friend manner. Eg. Slougter process, meat product processing (like burger, sousage, mortorela and the like), chick product, fruit and vegetable processing.

4.1. Processing parameters and setting in beef meat processing.

A.Halal killing box - Used to turn the cattle over easily for killing

1. Safe for operator, less hurt to cattle body
2. Adjustable according to cattle size
3. Good animal welfare

B. Cattle de -hiding machine - Used to remove the cattle skin down wards

1. Hydraulic-drive, stable pulling performance
2. Complete skin ensured, less meat loss
3. Easy operation and maintenance
4. Hydraulic system included

C. Carcass dressing line - Used to convey the cattle carcass to each work position to complete different processes

1. Converting from cattle rehanging to trimming process
2. Step type conveyer with adjustable speed
3. High degree of automation, labor saving

D. Pneumatic Elevation platform – for the operator to move up and down to finish his work

1. Pneumatic- driven, stable moving speed
2. Foot pedal control to avoid contamination
3. Equipped with anti-slip standing board and operator gurderails
4. Single pillar and double pillar type for options

E. Synchronous inspection system- this system can synchronously convey the carcass, white and red viscera for inspection

1. Special design greatly reduce labor intensity
2. The hook and trays can be automatically cleaned and dis infected after use
3. Three types suitable for different slaughter capacities

F. Automatic carcass washing machine - Used to wash and clean the blood and dirties on carcass surface

1. Auto- induction system, start spraying only when carcass enters for water saving
2. Automatically movable sprayers with high pressure device, good cleaning effect
3. Fully automatic, save labour
4. Cooling down the carcass during washing

Self-Check -4	Written Test

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

1. **Automatic carcass washing machine is (2pts)**:
   A. Auto- induction system, start spraying only when carcass enters for water saving
   B. Automatically movable sprayers with high pressure device, good cleaning effectC
   C. Fully automatic, save labour
   D. Cooling down the carcas s during washing
   E. E All
2. One of the processing parameter /setting in beef meat processing help the operator to move up and down to finish his work**(2pts)**:
   A. Automatic carcass washing machine
   B. Synchronous inspection system
   C. Pneumatic Elevation platform
   D. Cattle de -hiding machine

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

Instruction sheet

LG # 74	LO 2: **Set up the line for operation**

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

- Identifying and confirming cleaning and maintenance requirement
- Inspecting equipment to confirm condition
- Selecting or adjusting machine settings
- Entering processing or packaging parameters
- Checking and adjusting equipment performance
- Carrying Pre-start checks required
- Completing Line setup
- Reporting the line is ready and safe
- Conducting Work with workplace environmental guidelines.
- Notifying relevant personnel of setup completion

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

- Identify and confirm cleaning and maintenance requirements and status
- Inspect equipment to confirm condition.
- Select or adjusting machine settings
- Enter processing or packaging parameters
- Check and adjust equipment performance
- Carry pre-start checks required
- Complete line setup
- Report the line is ready and safe
- Conduct work with workplace environmental guidelines
- Notify relevant personnel of setup completion

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
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8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet-1. Identifying and confirming cleaning and maintenance requirement

1.1. Identifying and confirming cleaning

Cleaning is the removal of dirt and organic substances, such as fat and protein particles from surfaces of walls, floors, tools and equipment. Through the cleaning procedures, high numbers of microorganisms (90% and more) present on the mentioned objects will be removed. However, many microorganisms stick very firmly to surfaces, in particular in tiny almost invisible layers of organic materials, so called biofilms, and will not entirely be removed even by profound cleaning but persist and continue multiplying. Inactivation of those microorganisms requires antimicrobial treatments, carried out in food industries through hot water or steam or through the application of disinfectants. Disinfectants are chemical substances, which kill microorganisms but should not affect human health through hazardous residues and not cause corrosion of equipment. When starting cleaning and disinfection/sanitation measures all food products must be removed from the area because:

- Physical cleaning with pressurized water may stir up dirt or produce contaminated water droplets (aerosol), which could contaminate meat present in such rooms.
- Chemical cleaning/disinfection may produce toxic residues when in contact with remaining meat or meat products.

Cleaning and disinfection procedures in the meat industries are complex processes depending on the surfaces to be treated and the kind of contamination to be removed. Selection of suitable chemicals for cleaning or for disinfection may require special knowledge. All these factors can make correct cleaning and disinfection a difficult task for the personnel involved. However, staff must be made aware that efficient cleaning and disinfection is of utmost importance for product quality and safety.

General purposes of cleaning are:

- To reduce the risks from food hazards-food poisoning and foreign body contamination
- To comply with local and international legislation
- To meet specific customer requirements.

- To meet the requirements of global food safety standards (GFSI)
- To maintain positive audit and inspection outcomes
- To allow maximum plant productivity
- To present a hygienic visual image
- To promote safe working conditions for staff, contractors and visitors
- To maintain product shelf-life
- To avoid pest infestation

The selection of a cleaning procedure is determined by the nature of the product to be cleaned and by the types of contaminant to be removed. In general, more than one type of cleaning procedure is required to remove the variety of contaminants found on most foods.

1.2. Cleaning techniques

The first step in floor and equipment cleaning is to physically remove scrap, i.e. coarse solid particles, with a dry brush or broom and shovel. This is usually referred to as “dry cleaning”. 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.

A. Manual cleaning using brushes or scrapers is widely applied in smallscale operations although labour and time-intensive.
B. High pressure cleaning. a cleaning method commonly used in the meat industries the pressurized water is applied by high pressure units and special spraying lances. The pressure should be between 30-70 bar and the spraying nozzle ≤15cm from the surface to be cleaned.
C. Cleaning with equipment producing a pressurized steam/water-mix is even more efficient as impact temperatures of approx. 100^{o} C can be achieved.
D. Alkaline cleaning agents
E. Acid cleaning agents
F. Neutral cleaning agents

In general it is very important to use the cleaning methods and identify the cleanness and sanitation of equipment before starting meat product processing and regular checkup is very important.

1.3 Maintenance

An often-neglected issue when designing machines or setting up production areas is giving sufficient consideration for maintenance, whether repairs, cleaning, or tune ups. Clearance and access should ideally be provided, along with equipment features that facilitate the ease of maintenance

From a human factors perspective, the worst issue for maintenance is lack of clearance. Many tasks would not be nearly as physically demanding or time consuming if a person could access the job easily in a good working position.

Consequently, when designing machinery and production operations, it is critical to evaluate ease of access to items that may need eventual repair. Although, it may not be possible to eliminate all instances working in awkward positions, many bad situations are best averted in planning stages, sometimes with little or no extra cost.

Furthermore, even if it is not be possible to eliminate the need to work in difficult locations, it may still be possible to:

- Reduce the time in this position, and/or
- Reduce the force involved with the tasks.

Either of these can make a marked improvement in the work.

Self-Check -1	Written Test

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

1. _____is a cleaning method/technique commonly used in the meat industries (2pts)
   A. Manual cleaning
   B. pressurized cleaning
   C. Alkaline cleaning agents
   D. Acid cleaning agents
2. Mention at least five general purposes of cleaning? (5pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1

2

- _____
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- _____
- _____

Information sheet-2 Inspecting equipment to confirm condition

The purpose of an inspection is to identify whether work equipment can be operated, adjusted and maintained safely, with any deterioration detected and remedied before it results in a health and safety risk. Not all work equipment needs formal inspection to ensure safety and, in many cases, a quick visual check before use will be sufficient. However, inspection is necessary for any equipment where significant risks to health and safety may arise from incorrect installation, reinstallation, deterioration or any other circumstances. The need for inspection and inspection frequencies should be determined through risk assessment

2.1 What you must do

You should inspect work equipment if your risk assessment identifies any significant risk (for example, of major injury) to operators and others from the equipment's installation or use. The result of the inspection should be recorded and this record should be kept at least until the next inspection of that equipment. Records do not have to be made in writing but, if kept in another form (eg on a computer), these should be held securely and made available upon request by any enforcing authority.

Work equipment that requires inspection should not be used, unless you know the inspection has taken place. Where it leaves your undertaking, or is obtained from another (eg a hire company) it should be accompanied by physical evidence of the last inspection, such as an inspection report or, for smaller items of equipment, some form of tagging, colour coding or labelling system.

2.2 What you should know

Specifies the circumstances where inspection is required to ensure healthy and safe conditions are maintained:

- where the safety of work equipment depends on the installation conditions, it should be inspected after installation and before first use, and after reassembly at any new site / location

- at suitable intervals, where work equipment is exposed to conditions causing deterioration liable to result in dangerous situations
- each time exceptional circumstances (eg major modifications, known or suspected serious damage, substantial change in the nature of use) are liable to have jeopardized the safety of the work equipment

2.1. Coverage of inspection

This will depend on type of work equipment, its use and the conditions to which it is exposed. This should be determined through risk assessment and take full account of any manufacturer's recommendations. The advice of others, such as trade associations and consultants, as well as other sources like published advice on health and safety, may also be helpful.

An inspection should concentrate on those safety-related parts which are necessary for the safe operation of work equipment and, in some cases, this may require testing or dismantling. However, not all safety-critical features on a particular item of work equipment may require inspection at the same intervals.

An inspection can vary in its extent, as the following demonstrate:

- quick checks before use (eg electric cable condition on hand-held power tools, functional testing of brakes, lights on mobile machinery)
- weekly checks (eg presence of guarding, function of safety devices, tyre pressures, and the condition of windows, mirrors and CCTV on mobile plant)
- more extensive examinations, undertaken every few months or longer (eg general condition of a ladder, close examination of a safety harness, portable appliance testing)

Records are not normally required to be made for the simplest pre-use checks.

The use of checklists can assist but these, and the records made, should be tailored to the particular type of work equipment to minimise the burden to what is strictly necessary for safety. Requiring too much detail too often can lead to inspection activity becoming burdensome with the risk of a superficial 'tick box' approach or even, in some cases, the inspection activity ceasing altogether. You only need to inspect what is necessary for safety.

2.2 Re-inspecting work equipment

Work equipment which is exposed to conditions causing deterioration that could result in a dangerous situation should be inspected at suitable intervals, and after every event liable to jeopardize its safety. The frequency of inspection may vary, depending on environmental conditions (eg equipment subject to harsh outdoor conditions is likely to need more frequent inspections than if used in an indoor environment).

The frequency of inspection should be determined through risk assessment, taking account of the manufacturer's recommendations, industry advice and your own experience. It may be appropriate to review the frequency of inspection in the light of your experience. Intervals between inspections can be increased if the inspection history shows negligible deterioration, or shortened where experience shows this is necessary to prevent danger.

2.2. Inspection of work equipment by:

Equipment can be inspected by anyone who has sufficient knowledge and experience of it to enable them to know:

- what to look at
- what to look for
- what to do if they find a problem

The necessary level of competence will vary for inspections, according to the type of equipment and how / where it is used. The nature of these inspections does not have to be determined by the same person who undertakes them, provided the person determining them is competent. This can often be done in-house by experienced staff, taking account of:

- the manufacturer's recommendations
- industry advice
- their own experience of the equipment, its use, the particular factors of the workplace and the people using the work equipment

2.3 Inspection Principles

When conducting inspections, follow these basic principles:

- Draw attention to the presence of any immediate danger - other items can await the final report.
- Shut down and "lock out" any hazardous items that cannot be brought to a safe operating standard until repaired.
- Do not operate equipment. Ask the operator for a demonstration. If the operator of any piece of equipment does not know what dangers may be present, this is cause for concern. Never ignore any item because you do not have knowledge to make an accurate judgment of safety.

- Look up, down, around and inside. Be methodical and thorough. Do not spoil the inspection with a "once-over-lightly" approach
- Clearly describe each hazard and its exact location in your rough notes. Allow "on-the-spot" recording of all findings before they are forgotten. Record what you have or have not examined in case the inspection is interrupted.
- Ask questions, but do not unnecessarily disrupt work activities. This interruption may interfere with efficient assessment of the job function and may also create a potentially hazardous situation.
- Consider the static (stop position) and dynamic (in motion) conditions of the item you are inspecting. If a machine is shut down, consider postponing the inspection until it is functioning again.
- Consider factors such as how the work is organized or the pace of work and how these factors impact safety.
- Discuss as a group, "Can any problem, hazard or accident generate from this situation when looking at the equipment, the process or the environment?" Determine what corrections or controls are appropriate.
- Do not try to detect all hazards simply by relying on your senses or by looking at them during the inspection. You may have to monitor equipment to measure the levels of exposure to chemicals, noise, radiation or biological agents.
- Take a photograph if you are unable to clearly describe or sketch a particular situation.

2.3. Meat inspection

Adequate facilities for meat inspection must be provided, including means of approaching carcasses and organs during inspection, as well as appropriate facilities, including good lighting, washing stations, knife sterilizers, separate room for retained meat, office, etc.

Figure. 22 Inspecting

Self-Check -2	Written Test

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

1. Mention at least two basic principles of inspection? (4pts)
2. Equipment inspection enables inspector to know _____, _____ and _____(3pts)
3. What are the purpose of inspection? (3pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1_____

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Information sheet 3 - selecting or adjusting machine settings

3.1. Introduction

An optimum procedure for setting machine or adjusting process

An important problem in industry is that of adjusting or setting machine**.** An important aspect of this problem has been dealt with Burr,[1,2,3] who made a detailed and valuable study concerning whether or not a machine process could be approved for level of operation on the basis of measurements made on piece parts or items from the process. In this article we consider a somewhat different problem: namely, that of determining just how one should go about adjusting the machine or process to the desired level.

3.2. The adjusting problem

It is well known fact that for a given or constant setting, a machine or process will turn out items or piece parts which exhibit variation. The measurement and actual size of the piece parts or items will generally be clustered about some mean or central value.

3.3. Recommended Adjusting procedure

After producing the first item, we adjust the machine or make a correction in setting which amounts to the difference between the desired level and the measured value of the first item. When the measured value of the first item is greater than the desired level, then the machine or process is, of course adjusted so as to decrease the size of the next item, and vice versa. After making adjustment and producing the second item, we make a correction in level of the machine equivalent to only one-half of the difference between the desired level and the measurement of the second item. The adjustment after the third item is to be only one third of the deviation of the measured value of third item from the desired level. Thus, in general after producing the n^{th} item the correction or adjustment to be made should be 1/n of the measured deviation of that item from the desired level. By following this procedure it is guaranteed that the true mean level of the items produced will converge rather than rapidly to the desired level.

This procedure can also be extended to groups of items.

We offer precision adjustment of new or older machines upon request. The machine is disassembled to functional units or pieces, checked, modified and/or re-grinded or

scraped if need by to the best possible precision. It means in case of lathe, we grind bottom sliding surfaces on the bed, contact surfaces on headstock (to set up the headstock parallel with bed), sliding surfaces of tailstock (parallel with bed too), sliding surfaces of cross slide (perpendicularly to bed), sliding surfaces of compound, contact surfaces of tool post. In case of milling machine, we straighten table slide (top clamping side if need by), grind sliding surfaces of cross slide, guides on base, on column, contact surface on headstock, all perpendicular to the working table.

3.4 Production line lay out

Here, offered humbly, are five ideas for radically rethinking how to manage the manufacturing line:

1. Forget output, focus on profits
2. End the annual review
3. Rethink teamwork
4. Recognize process rather than results
5. Take a lesson from gamers.

Note: The selection of equipment and machine depends on the objective of the enterprise and product produced in the production

Self-Check -3	Written Test

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

1. Mention the five ideas for radically rethinking how to manage the manufacturing line (5pts)
2. What are the problem of adjusting machine?(3pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet- 4. Entering processing or packaging parameters

4.1. Introduction

There are several packaging possibilities available in the market to be used with meat products, comprising different materials such as metals, plastics, and carton. This is fully dedicated to explore the different combinations for plastic packaging, a very versatile and efficient packaging presentation for such products used in formats as vacuum packages, modified atmosphere packaging, pasteurization, sterilization, freezing, and other non-thermal processing such as high pressure processing (HPP).

Food packaging is not only an art of enclosing or wrapping a food product but it also

- Protects the food from deterioration in a limited manner.
- It must ensure safe delivery of the product at the minimum cost.
- The cost of packaging has to be reasonable
- Packaging may not improve the existing quality of a product but it should help in maintaining its keeping quality during storage, transport and deterioration

4.2. Factors of packaging design

The factors considered in packaging design at the stage of product and process development are summarized in below table

Table 1. Factors in packaging design

Consumer	Buying, transporting, storing, using, eating, disposing
Product	Containment Protection in external environment, distribution Presentation for communication, promotion, selling Use by consumer: convenient, dispensable, ergonomic, information, Legal requirements
Process	Process Preservation of food, processing ability, interaction with processing, Product packaging quality Machine ability in making, forming, filling, closing
Distribution	Outer packing, unitization, transport, storage conditions Retailer needs Storage, display, communication, bar coding, tamper-proofing
Environment	Resources used: energy, raw materials Waste: reuse, recycle, or disposable

4.3. Packaging types

Packaging may be of several different types. For example, a transport package or distribution package can be the shipping container used to ship, store, and handle the product or inner packages. Some identify a consumer package as one which is directed toward a consumer or household.

Packaging may be described in relation to the type of product being packaged: medical device packaging, bulk chemical packaging, over-the-counter drug packaging, retail food packaging, military materiel packaging, pharmaceutical packaging, etc.

It is sometimes convenient to categorize packages by layer or function: primary, secondary, etc.

- Primary packaging is the material that first envelops the product and holds it. This usually is the smallest unit of distribution or use and is the package which is in direct contact with the contents.
- Secondary packaging is outside the primary packaging, and may be used to prevent pilferage or to group primary packages together.
- Tertiary or transit packaging is used for bulk handling, warehouse storage and transport shipping. The most common form is a palletized unit load that packs tightly into containers.

4.4 Types of packaging materials

Depending on the hardness, the packaging materials are of three types:

4.4.1 Flexible packaging components

Meat products are broadly packaged using flexible plastic packaging materials or a combination of flexible plastic packaging and rigid containers or carton boards. As packages are in general subjected to low storage and transportation temperatures, mechanical strength of polymeric materials is a must for proper protection of packaged goods in the final applications. Since first wraps are based on polyvinylidene chloride (PVDC) polymers till multilayer films with a combination of several attributes, meat packaging is one

of the most complex fields into food packaging, combining a list of materials and processes to achieve proper protection, allowing consumption

Aiming to illustrate the main elements of meat packaging, the different features can be bundled into few elements that provide food protection: (1) sealing for proper hermeticity, (2) barrier to provide proper internal environment for food protection, and (3) abuse resistance to avoid failures due to mechanical impact and/or internal puncture from cured and bone meat pieces.

The different elements are combined into single packaging structures via modern processes such as coextrusion, which multiple extrusion screws pump materials into a single extrusion die and combine the materials all together, adding up to 13 layers of different materials to deliver all needed packaging features. Another traditional methodology to combine flexible polymeric packaging materials is to adhere all together using lamination adhesives and/or extrusion coating. Although both processes can provide proper functionalities, the use of coextrusion has grown rapidly during the last years over lamination as it simplifies production process, eliminating one step and producing packaging films with all performance requirements directly from extrusion.

The role of packaging designers, from the material selection to the fabrication process selection, is key to maximize the packaging impact on extending product shelf life, reducing footprint from both packaging and product and providing correct end of life for recycling, reusing, or disposing.

4.3.1. SEMI-RIGID PACKAGING MATERIALS

I. Paper board

- Sheets are cut
- folded into desired form and glued
- Corners can be made stronger
- The material can be made as set up paper board boxes or folding carton or tray as per the demand.
- It provides convenience, strength and good product protection.

II. PET (polyethylene terephthalate) and PVC plastic sheets

- Can be moulded in shape, size and colour to suit specific product requirements. ′
- PET bottles and containers are extremely clear, virtually unbreakable and very light weight.
- They are ideal for the packaging of pickled meat products.
- They provide enhanced visual appeal to the products.

III. Plain aluminium foil of higher guage

- Either alone or in combination with paper or plastic foils can be pressure formed into desired shapes to serve as semi-rigid containers for various types of food products.

IV. Moulded pulp ′ Containers are the cheapest packaging for the shell eggs.

- They allow wholesale trading of eggs along with the tray.

4.3.2. Rigid packaging materials

I. Glass containers

- Are very old and versatile packages for food packaging.
- It is chemically inert and is an excellent barrier to solids, liquids and gases.
- It can be moulded in various shapes and sizes and also allows excellent product visibility.
- Glass bottles are used for packaging meat pickles etc.
- The main drawbacks of glass containers are the risk of breakage and comparatively heavy weight.

II. Metal cans

- Are primarily used for commercially sterilized food products.
- Iron sheet used for making can has very thin tin coating on either side.
- It is generally applied to check rusting and corrosion of metal cans on long term storage. ′
- To make the metal can more suitable for food application, a further very very thin coating of enamel or lacquer is applied to the tin.

- For canning of meat products, a sulphur-resistant lacquer is preferred.
- Can bodies are soldered or welded. The product is hermatically (air tight) sealed in the can.

4.4. Choosing packaging machinery

This includes an assessment of technical capabilities, labor requirements, worker safety, maintainability serviceability, reliability , ability to integrate into the packaging line, capital cost, floor space, flexibility (change-over, materials, multiple products, etc.), energy requirements, quality of outgoing packages, qualifications (for food, pharmaceuticals, etc.), throughput, efficiency, productivity, ergonomics, return on investment, etc.

Packaging machinery can be:

1. purchased as standard, off-the-shelf equipment
2. purchased custom-made or custom-tailored to specific operations
3. manufactured or modified by in-house engineers and maintenance staff

All packaging must be sourced from suppliers who are cost effective, innovative and technically competent.

4.5. packaging and packaging procedures

4.5.1. Packaging of fresh meat

- For short term storage, most learned people in India wrap fresh meat in polyethylene pouches or bag.
- The polyethylene should be food grade, transparent and fairly thick (150-200 gauge).
- In developed countries, fresh meat chunks are kept in a rigid plastic tray and overwrapped with polyethylene.
- Besides this popular film can also use polyproplylene, polyvenylidine chloride or cellophane films for wrapping fresh meat cuts.
- This is another type of film called shrink film which is used for wrapping large and uneven cuts of fresh meat and dressed poultry.
- The carcass cuts or dressed poultry are first wrapped in shrink film which is then immersed in hot water (90°C) for a few seconds

- For long term storage, vacuum packaging of fresh meat and storage in refrigerator is ideal.

4.5.2. Packaging of frozen meat

- The meat to be stored in frozen condition must be properly packaged, otherwise it develops “freezer burn’
- For frozen storage of meat, the packaging material should have good strength even at freezer temperature.
- It should have very little permeability to water vapours
- It should also have very good grease resistance.
- Low density polyethylene (150-200 gauge) is the least cost protective film which can withstand low temperature and maintain clarity.
- Polyester or nylon/ PE laminate can also serve as ideal over-wrap.
- Heat shrinkable low density polyethylene also provides all the required functional properties for this purpose.

4.5.3. Packaging of cured meat

- Cured meat products like ham, bacon, luncheon meat and frankfurters are prepared after treating meat with table salt (sodium chloride) and salt petre (sodium nitrite) along with other additives.
- Curing develops a very desirable pink colour and a much sought after cured flavour
- These two specific characteristics need to be protected in the packaging of cured meat products
- The packaging techniques for short term storage are overwrapping in polyethylene or shrink packaging for irregular cuts like hams.
- For long term storage of blocks, luncheon meat etc., vacuum packaging in laminates is ideal.
- Modified atmosphere packaging in gaseous mixture of 85-90% nitrogen and 10-15% carbon dioxide also keeps the cured meat well for about 12 weeks at 0-4°C.MAP

4.5.4. Packaging of cooked meat products

- Most meat products like meat patties, sausages, nuggets, meat balls etc. are cooked to an internal temperature of 75°C to kill most of the microorganisms

- These meat products can be packaged in pouches of polyethylene, polypropylene, PVDC(polyvinylidene chloride) etc. for short term storage lasting 10-12 days in a refrigerator (0-4°C)
- Cooking in hermetically (air tight) sealed metal cans makes the products commercially sterile.
- These canned products are shelf stable at ambient temperature for a period of 2 years
- Retort pouches are also available in some markets.

4.5.5. Packaging of dehydrated meat

- All the dried meat products are susceptible to ingress/entrance of moisture and rancidity development.
- So, the packaging material should not allow any moisture or oxygen inside the product.
- Aluminium foil/polyethylene laminate is ideally suited for this purpose.
- If nitrogen is also filled in the package of a crisp product, it will protect the product against breakage by providing cushioning from all the sides.

4.6. Storing

Meat should be stored in the coldest part of the refrigerator. As storage temperatures approach 40°F perishability increases. Rapid growth of bacteria begins at about 50°F. Meat in-transit from the place of purchase, or left to thaw at room temperature, invites the growth of spoilage organisms.

Self-Check -4	Written Test

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

1. The selection of a sealing material for a flexible packaging structure depends on deep analysis of_____, _____, _____and _____(3pts)
2. Mention the important criteria of choosing packaging machinery?(5pts)
3. All packaging must be sourced from suppliers who are (2pts)
   A. cost effective
   B. innovative
   C. technically competent
   D. All of the above

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet- 5. Checking and adjusting equipment performance

5.1. Introduction

The Overall Equipment Effectiveness metric can be used to examine the efficiency of manufacturing process sub-components such as a specific machine, a single production line, or a stand-alone manufacturing cell. It is particularly useful in discrete manufacturing and must be evaluated in context with the overall manufacturing system – alone, it does not provide enough context and can be misleading.

5.2. Performance

Performance takes into account anything that causes the manufacturing process to run at less than the maximum possible speed when it is running (including both Slow Cycles and Small Stops).

Performance is the ratio of Net Run Time to Run Time. It is calculated as:

Performance = (Ideal Cycle Time × Total Count) / Run Time

Ideal Cycle Time is the fastest cycle time that your process can achieve in optimal circumstances. Therefore, when it is multiplied by Total Count the result is Net Run Time (the fastest possible time to manufacture the parts).

Since rate is the reciprocal of time, Performance can also be calculated as:

Performance = (Total Count / Run Time) / Ideal Run Rate

The OEE Performance Calculation is defined as follows and is further explained below:

OEE = Availability x Performance x Quality

- Availability is the percentage of scheduled time the machine is operating, as referred to as Machine Uptime
- Performance indicates the percentage of a machine's designed speed at which it has been (or is) operating
- Quality is indicated by the percentage of the Good Units produced to Total Units https://spruiktec.com/oee-performance/

5.3. The Need for Accurate OEE Calculation

While OEE calculations are not very complicated, they must be carefully considered in order to be valid, especially when aggregated beyond the equipment part number level to include multiple machine processes or manufacturing cell operations. Once the OEE score has been calculated, it is critically important to put it in context and understand what is affecting the score. By doing this, losses can be identified and eradicated.

OEE is a management tool that addresses multiple issues with production by gathering data points that can provide critical information about your manufacturing process. The key to quality process data lies in correctly analyzing and calculating your OEE performance results to glean specific process information that is then used to make continuous process improvement decisions.

Accurate OEE performance calculations can be used as a framework to understand and improve machine availability, machine performance, and production quality by uncovering the root causes and issues that lead to machine downtime, the source of low machine performance, or the discovery of factory floor inefficiencies. Continue reading to discover how to calculate OEE, and which method of OEE calculation is preferred

The Benefits of OEE Performance Calculations

OEE calculations alone will only provide you with data about your manufacturing equipment or process. The number must be considered in context and used as a means to dig into the “why.” It is best to use OEE as a metric in combination with lean manufacturing strategies and as part of TPM (Total Productive Maintenance) program. When using OEE with these systems, your in-house manufacturing can realize the following benefits which can contribute to increased margins through improved production that results in fewer equipment breakdowns, production line stops, and product defects.

- Reduce the time to investigate the root cause of machine breakdown or production bottlenecks
- Expect a shorter equipment ROI due to increased machine utilization
- A decrease in manufacturing costs due to the elimination of wasted time and activities
- Improvement in product quality resulting in increased customer satisfaction

When OEE calculations are correctly analyzed, and placed in the context of the entire system, it allows companies to create a thriving, continuous improvement environment.

Here is an interesting example. Look at the following OEE data for two sequential weeks.

OEE factor	Week.1	Week 2.
OEE	85.1%	85.7%
Availability	90.0%	95.0%
Performance	95.0%	95.0%
Quality	99.5%	95.0%

OEE is improving. Great job! Or is it? Dig a little deeper and the picture is less clear. Most companies would not want to increase Availability by 5.0% at the expense of decreasing Quality by 4.5%

Self-Check -5	Written Test

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

1. What are the main difference between effectiveness and performance? (4pts)
2. Write the formula of OEE and performance (4pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet 6.Carrying Pre-start checks required

6.1. Introduction

A pre-start inspection involves a routine examination of a piece of equipment by its operator that is standardized via a checklist. Whether it be a light vehicle, heavy vehicle, mobile plant or tools, pre-start inspections are an important task with financial, and more importantly, safety implications

6.2. Importance of pre-start checks

Another benefit of the pre-start checklist is that your employees can identify small problems before they become big ones. One more important benefit of Pre-Start Checks is that the inspection uncovers defects that might cause damage to the equipment if it is started.

Safety should always be the top priority in a facility with production machinery. Proper safety measures help to ensure that workers are safer, and it's simply a smart business practice. Shutting down a machine, factory or jobsite to address a safety incident can be expensive in terms of lost work time, lost revenue, as well as possible insurance issues. Safety incidents can also cause additional obstacles in terms of reports, audits, or legal issues .A step towards a safer work environment starts with creating a culture that puts safety first, beginning with the management and supervisors setting the right example. Management can demonstrate that they take safety seriously. For example, if the company president visits the Machine Safety Checklist

Having a safety checklist on hand can help the workers to verify that a worksite is safe. There are many topics related to machine safety that should be considered in any safety plan. These include:

- Mechanical hazards
- Electrical hazards
- Other hazards
- Protective equipment
- Maintenance and repair
- Safeguards

- Training

Most of the safety practices in all of these areas are common sense. The challenge on any factory floor or jobsite is to get in the habit of checking everything every time you use a machine. Often the operation of a machine becomes second nature to a worker, they may not consider what could go wrong or that they are not following the best practices for their own safety.

Here's a machine safety checklist with questions that can be reviewed regularly. This covers both safety equipment and components, such as limit switches on the machines, but equally important are practices and policies so the workers take the additional steps necessary to avoid putting themselves in jeopardy.

Ensure your machines are checked before they are used.

Remember to...

- Pre start checks must be made to ensure equipment is not damaged on start up. This is to prevent possible injury to personnel during start up and the operational status of the equipment.
- Ensure that equipment is properly ventilated. Most machines can get very hot and need to have a proper airflow around them to avoid damage.
- Check that equipment is plugged in correctly. For example: You should never use double adapters to plug in multiple devices. If more than one device needs to be connected to power you would always use a power board.
- Use safety guards or safety clothing (if applicable).
- Some equipment can have areas that can cause injury such as cutting blades and overheated areas. They will generally have safety guards or may require safety clothing (such as eye or ear protection) to be worn.

6.2.1. Does this apply to your workplace?

- The occurrence of safety checks will depend on the type of equipment or work tasks performed.

- The potential hazard or danger associated with the work performed and equipment used will always influence the frequency of safety checks.

6.3. Prestart Check List

The prestart checklist ensures the operator assessments are recorded and saved - this acts not only as a verification that checks are done, but also an accountability measure for operator to take responsibility for their machine.

6.3.1. External

- The grounds should be kept clean and free from rubbish at all times.
- The external rubbish depot should be kept tidy and orderly.

6.3.2. Internal

- Floors should be sloppy to facilitate easy drainage and cleaning.
- All storage and dispatch areas should be regularly inspected for possible cross contamination or damage to raw materials/finished product.
- . All stored material should be clearly identified.
- The plumbing should be kept in a sound state and all fittings should be of an approved sanitary type.
- The lighting should, at all times, be adequate to meet safe work standards, especially in the processing areas, to ensure safe operation of the equipment and to assist with cleaning. Light fittings should be enclosed wherever possible.
- All equipment should be installed so that easy access is possible for operating, servicing and routine cleaning. .
- All toilets should be well ventilated, kept clean, and suitably supplied with hand washing sanitiser, hot water and drying facilities.
- Adequate security and reconciliation procedures should be implemented for any chemical or biological materials at risk of diversion for illicit purposes identified by Science Industry
- A preventative maintenance program should be established to ensure that equipment is routinely

6.3.3. Equipment

- All equipment should be suitable for its intended purpose.
- Equipment should be of hygienic construction.
- All equipment should be designed for easy cleaning
- Thorough cleaning and sanitising SOPs should be established, documented and followed to ensure that equipment is clean, and contamination of product with cleaning and sanitiser residues is prevented.
- Where a primary and secondary refrigerant is used for cooling fermentations, checks should be made to ensure prompt detection of leaks should they occur.
- Pre-processing checks of all equipment and facility cleanliness should be made.

Self-Check -6	Written Test

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

1. Among many topics related to machine safety that should be considered in any safety plan, mention some of them included (5pts)
2. What are the benefit /importance of Pre-Start Checks is? (4pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet 7. Completing Line setup

7.1. Introduction

In the above information sheets we have discussed all about the most important steps like identifying and confirming of cleaning materials, inspection, selection and adjustment machine, entering processing and pre operational check are ver importan points . after doing so:

7.2. Confirming the completion of line set up

Line setup is completed to match production or packaging schedule and operating requirements.

During the complete of the line set up, the designer or operator should aware the manager/ supervisor about the completion of the line set up.by doing so the next activity will be

- Creating a schedule and start-up budget that includes training, testing, and start-up dates.
- Arranging for start-up assistance with major equipment suppliers.
- Obtaining initial supplies and spare parts and confirming availability during start-up.

Self-Check -7	Written Test

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

1. What are the next activities after completing line set up? (4pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1

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Information sheet -8. Reporting the line is ready and safe

A successful manufacturing line launch requires the development of a methodical design, implementation and commissioning plan. This is often developed as a team effort among the owner, equipment suppliers and an engineering group

A production line involves the movement of products that are manufactured in a linear process. This means that a product moves progressively from start to finish in a sequential manner. Food processing uses production lines to move from raw materials to packaged goods. This can be done after completion on the arrangement, inspection and cleaning and adjustment of materials and equipment. As soon as the line set up is completed, the line is ready to use. This can be ascertained from the record/checklists that the operator prepare. The recorded results should be reported and documented.

.

Self-Check -8	Written Test

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

1. How can we ascertain whether the line is ready and safe or not ? (4pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet -9. Conducting Work with workplace environmental guidelines

9.1. Introduction

The industry sector EHS guidelines are designed to be used together with the General EHS Guidelines document, which provides guidance to users on common EHS issues potentially applicable to all industry sectors. For complex projects, use of multiple industry-sector guidelines may be necessary. A complete list of industry-sector guidelines can be found at: www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

9.2. Industry-Specific Impacts and Management

The following section provides a summary of EHS issues associated with meat processing operations, along with recommendations for their prevention and abatement.

9.2.1. Environment General EHS Guidelines.

Environmental issues specific to meat processing may include the following

- Solid waste and by-products
- Wastewater
- Emissions to air
- Resource consumption

Community health and safety impacts during the construction and decommissioning of slaughterhouses are common to those during the construction of other industrial facilities, and are discussed in the General EHS Guidelines

9.2.2. Environmental Monitoring

Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during normal operations and upset conditions. Environmental monitoring activities should be based on direct or indirect indicators of emissions, effluents, and resource use applicable to the particular project.

9.2.3. Machine / Tool Safety

Equipment safety issues are mainly associated with the use of knives, mechanical saws, packaging equipment, and mincers. Cuts may be caused by sharp bones and edges on process equipment (e.g. stainless steel basins).

While conducting work of meat and meat product processing it is very important the above mentioned guide lines to be friend with environment

9.3. Food Safety Impacts and Management

A food product recall brought about because of contaminated or adulterated food products found in commerce that are attributable to a specific company can damage a viable business. If a company can trace its products to specific lot numbers then recall is a matter of removing all foods associated with specific lot numbers. Without this ability the business may be destroyed. With a robust food safety program in place a company can protect itself from product adulteration, contamination and the impacts of food recalls. Meat processing should therefore be performed according to internationally recognized food safety standards consistent with the principles and practice of Hazard Analysis Critical Control Points (HACCP)18 and Codex Alimentarius.19 Recommended food safety principles include: ·

- Respect “clean” and “dirty” zoning, designed in accordance with HACCP prerequisites (e.g. sanitary standard operating procedures) as discussed below;
- Ensure the cooling chain is unbroken for sensitive products requiring refrigeration;
- Facilitate tracing of like animal parts, so that all materials from carcasses detained by veterinary inspection can be removed;
- Ensure animal traceability systems continue to track products once released into commerce; ·
- Ensure efficient veterinary inspection, including examination of medical certificates (e.g. verification markings, tagging) for the animals;
- Comply with veterinary and local environmental regulation and precautions for waste, sludge, manure, and byproducts;
- Full institutionalization of HACCP prerequisites including:

✓ Sanitation

✓ Good management practices

- ✓ Pest control
- ✓ Chemical control
- ✓ Allergen control
- ✓ Customer complaints mechanism

Traceability and recal

9.4. Conducting Work according to line setup

As stated in the previous information sheets, after completing the line set up and it became ready for work the next task should be conducting work keeping the working environment and equipments are safe to conduct it. Even though different processing plant have different slaughtering line, size and equipment they use few examples are given below on production and processing.

9.5. Stunning/killing

The stunning box and equipment is tailored for each animal species; provision of suitable constraints facilitates best stunning practice. Stunned animals must be rapidly bled and shackled, fulfilling animal welfare requirements.

Blood is usually collected using contained drainage or a receptacle, but special equipment (hollow knives connected with tubing to a sealed tank) is required if blood is intended for human consumption. The stunning box must be physically separated from the carcass dressing area.

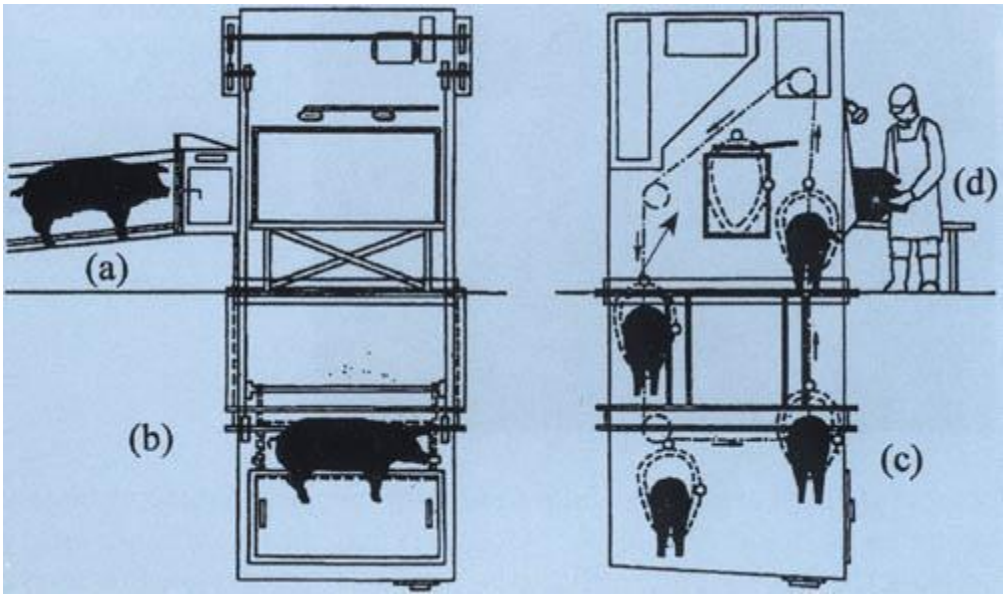
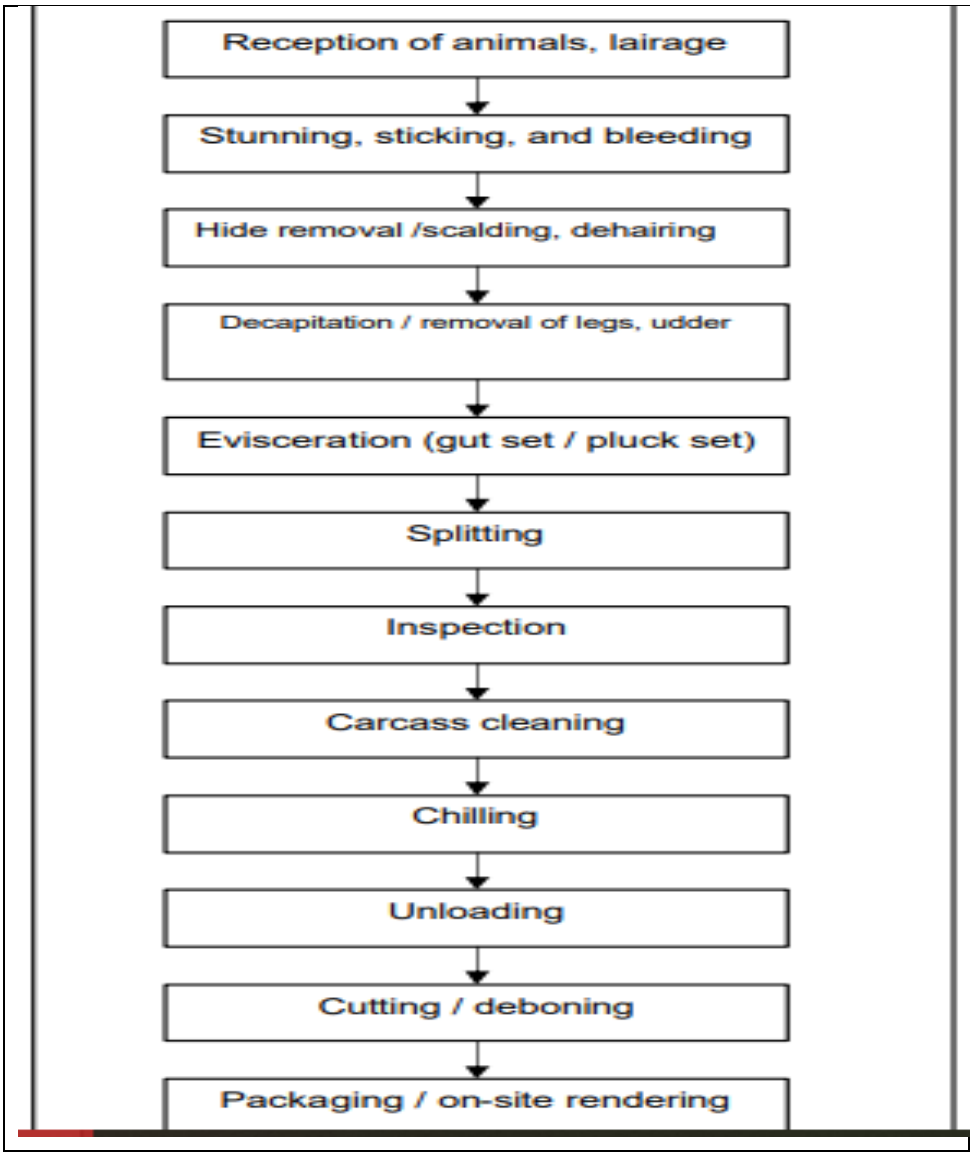


Figure 23. Stunning/ killing

9.6. Slaughter line

The layout of each abattoir depends primarily on the flow of operations. During construction planning, the consultant Official Veterinary Surgeon must have knowledge of the hygienic flow of operations for each species to be slaughtered. Within the slaughter line for each species, different operations must be physically separated into clean and dirty areas, and this must be extended to include staff and airflow. The guiding principle is that edible tissue, or paths of their movement, should not cross any dirty area.

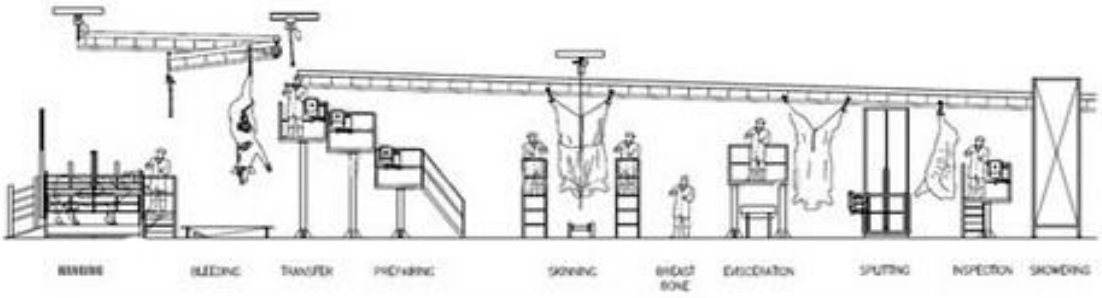
The only individual to move between clean and dirty areas is the Official Veterinary Surgeon, who may conduct both ante-mortem and post-mortem inspection; but this include between-areas sanitation. Within clean areas, there is a requirement for any dirty materials (e.g. digestive tract) to be removed from the space as quickly as possible.



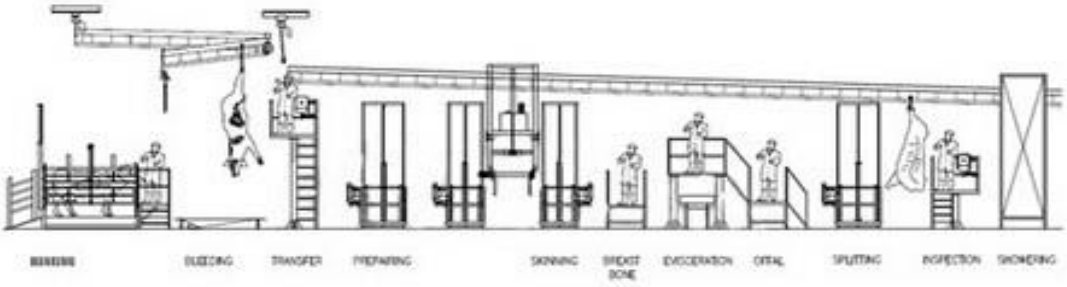
Diag. 2. Work flow from slaughtering to packaging

Figure 24. Slaughter line

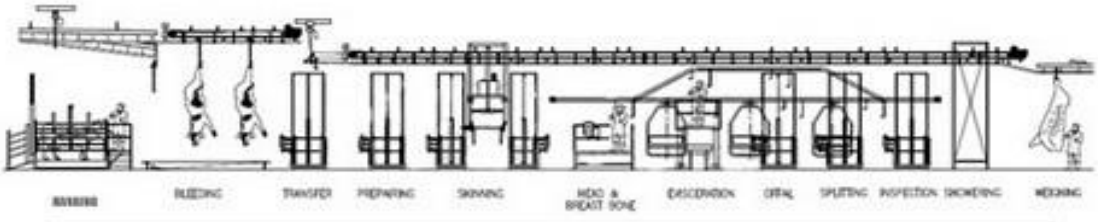
Different designs will be adopted for slaughterhouse with diffent capacities:



Suitable for cattle slaughtering lines for 15-20 heads per hour with non stop bleeding process and electric dehiding machine. Overheads inspection/supervision line.



Suitable for cattle slaughtering lines 30-40 heads per hour by gravity bleeding, electric dehiding machine, horn and hoof hydraulic slicing, heads splitting, breast bone saw, carcasses splitting, quartering, pneumatic transporter. Overheads inspection lines.



Suitable for cattle slaughtering lines 40-60 heads per hour with non stop bleeding. Double motorized chain lines for slaughtering and visceral-heads-offal inspection, automatic hooking up at regular intervals. Final rinsing.

Figure 25. slaughter line

9.7. Some figures of Equipment and machineries' for meat processing plant

Example one - Production steps for coarsely chopped fresh sausages

Step 1: Material composition
Left: back fat, middle: salt (above) and spices (below), right: lean meat with adhering fat and without coarse connective tissue

Step 2: Mixing of ingredients

Step 3: Grinding of mixture

Step 4: Casing preparation (soaking and rinsing natural pig casings)

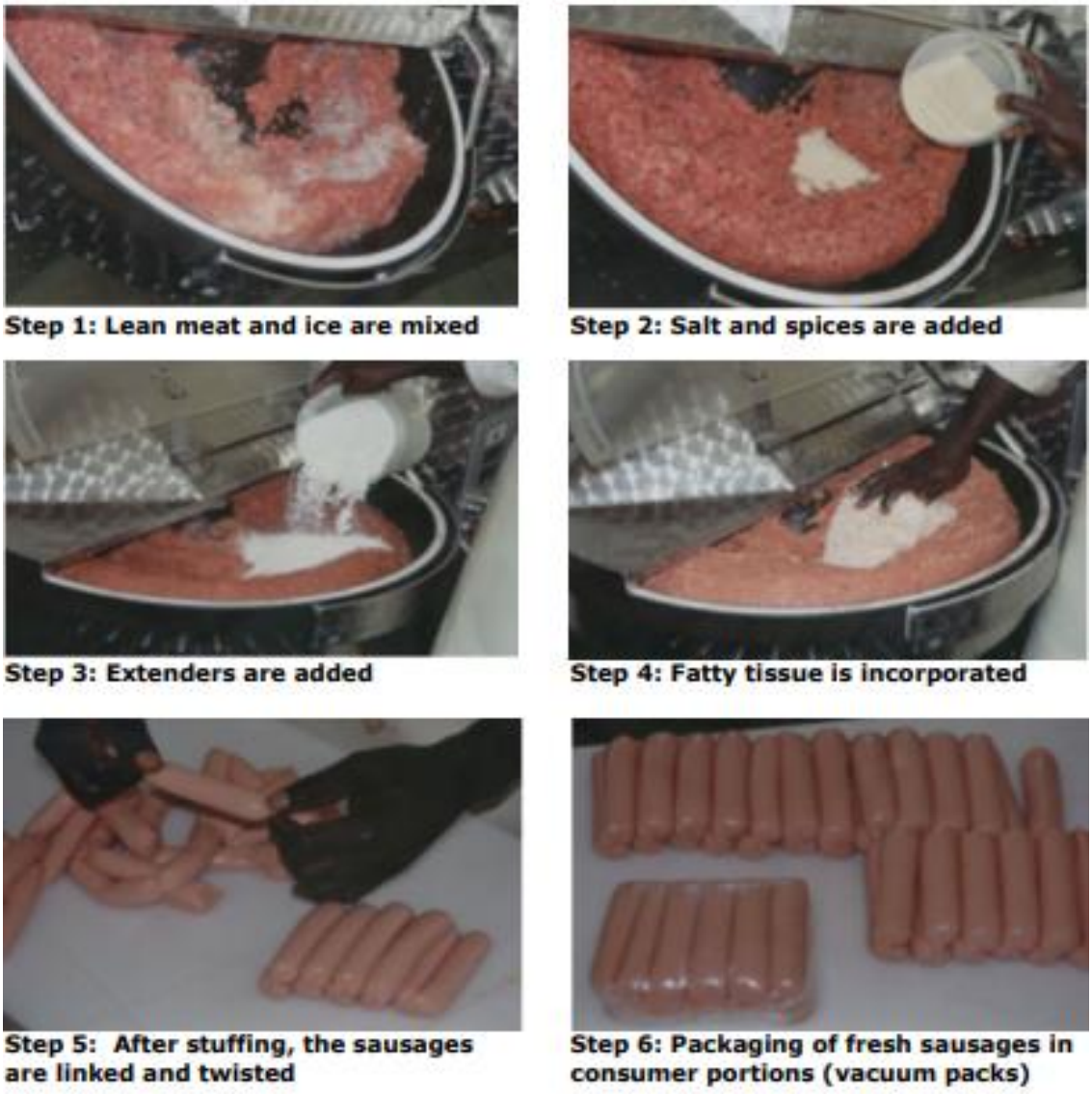
Step 5: Sausage stuffing (manual stuffer)

Step 6: Portioning and twisting

Step 7: Final fresh product

Figure 26. Coarsely chopped fresh sausages

Example two - Production steps for finely chopped fresh sausages



Step 1: Lean meat and ice are mixed

Step 2: Salt and spices are added

Step 3: Extenders are added

Step 4: Fatty tissue is incorporated

Step 5: After stuffing, the sausages are linked and twisted

Step 6: Packaging of fresh sausages in consumer portions (vacuum packs)

Figure 27. Finely chopped fresh sausages

9.8. Technological procedures

Meat processing techniques changed over the years following improved equipment designs and performances. The methods described below take into account the performance of the equipment expected to be accessible to small or medium scale meat processors in developing countries. The following processing steps achieve satisfactory final products: The chopping process (Fig. below)

Step 1: The lean meat portion is pre-minced and kept chilled (0˚C).

Step 2: The lean meat is placed in the bowl cutter with the salt and additives for the whole batch. The mixture is chopped for 5-10 rounds without ice. This step is called “dry-chopping”.

Step 3: Ice is added and the chopping continued at fast bowl chopper speed until the ice is evenly incorporated and a “sticky” lean batter is achieved. Now also the spices are added.

Step 4: The fat (pre-minced and chilled) is added and the mixture chopped at high speed until a homogeneous batter made of lean and fatty tissues is achieved.

Step 5: The final temperature of the batter should not exceed +12°C The extraction of muscle proteins can be further enhanced and a uniform distribution of all components in the mixture accelerated by:

- Sharp bowl chopper knives, high rotation speed (up to 7000 rpm)
- Specific knife shapes (cutting angles, etc., see Fig. 396)
- Increased number of knives (up to 8)
- Specific knife positioning for improved cutting sequence
- Passing the batter through emulsifying machines

Example 3. Production steps for finely chopped batter

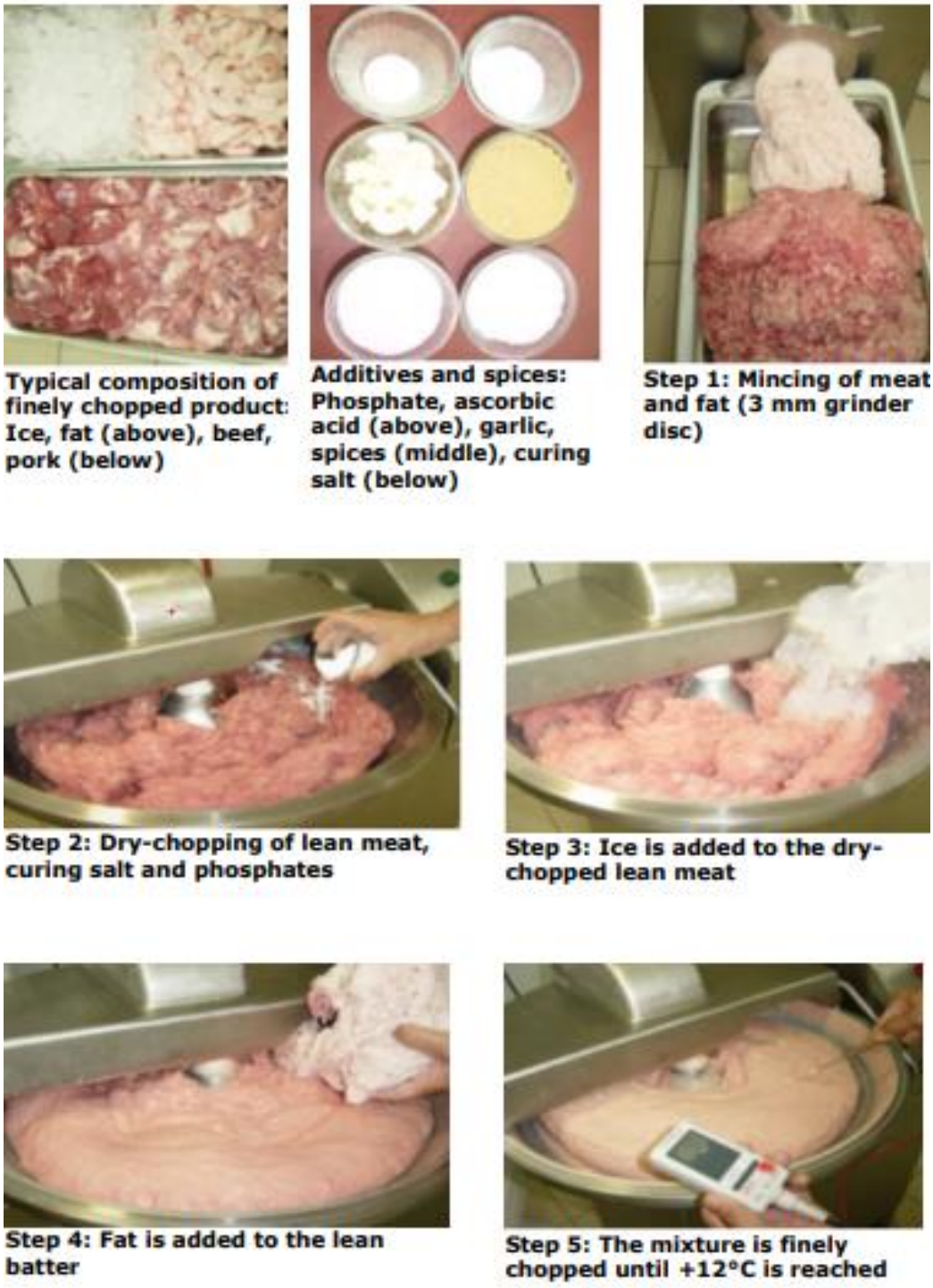


Figure 28. finely chopped batter

Example 4- Production steps for raw-cooked products with coarse meat ingredients

Meat and spices for coarse sausage type

Step 1: Mincing of meats to be added to finely chopped batter for coarse sausage

Step 2: Coarse material is added to finely chopped batter (above). Final mixture after a few rounds in the bowl cutter (below)

Step 3: Coarse sausage (final product). Coarse particles embedded in finely chopped basic matrix

Figure 29. raw-cooked products with coarse meat ingredients

Example 5: Corned beef processing flow line set up

Frozen beef → unfreezing → trimming → cutting → marinating → vacuum packing → High pressure sterilizing

Figure 30. Corned beef processing flow and equipment

Example 6. The Medium Scale Burger Patty Production Line machinery

Figure 31. 400mm Forming Machine

VER automatic burger forming machine can automatically produce tridimensional shapes such as chicken legs shape, fish shapes, nuggets etc. It is fit to mold pieces of meat or minced meat, semisolid dough, potato, vegetables, fish dough, or any moldable product, and prepared for molding by a stuffer. Air filling pressure are adjustable to allow decreasing the meat and still obtaining hamburgers at the same weight. VER forming machine is made with stainless steel and meet high standards

Figure 32. 400mm Battering Machine

The automatic battering machine has good combination with forming machine, breading machine, frying machine to help finish a full line production and for the secondary formation. This automatic battering machine is suitable for restaurants, bakeries, and other

food production industries planning to reduce worker stress along with time saving and safety.

Figure 33. 400mm Breading Machine

VER crumbling machine makes breadcrumbs easily up to 175lbs/hr. Provides high performance and easy maintenance. Fully constructed of stainless steel, and suitable for a wide range of applications including breading chicken, veal, pork & beef schnitzels, chicken nuggets, fish sticks, crumbled cheese sticks & much more. It can easily apply to different types of breading to food that has already been battered.

Figure 34. 400mm Preduster Machine

VER Pre duster coating machine are best fit for coating food processing. It sequentially coats the product in a number of steps that are usually referred to as ‘passes’. First the bottom layer is coated with flour on the conveyor belt. Second, flour evenly pour from top through unique belt on the product passing through. VER merge air flow system in the machine which helps to recycle the flour and remove any remaining flour.

Key.

VER - is derived from for VERFoodSolution mark

400mm - is a belt width of a machine

Example 7. Burger Patty production line

Figure. 35. 100kg/h Burger Patty production line

Machine over view

A. Raw materials meat (poultry, beef, mutton, pork etc), seafood (fish, shrimp, etc), vegetables (potato, pumpkin, lima bean, etc), cheese or the mixture of these materials.
B. Products- hamburger patty, chicken nuggets, chicken or beef steak, pumpkin /potato patty, different shapes of meat patty such as round meat patty, square meat patty and triangle meat patty etc by changing different shapes of mould.
C. Capacity-100kg/h burger we can customize for other capacities
D. Flow chart- forming starching crumb breading and powdering
E. Voltage – in china three phase 380v/50Hz we can make it according to customer's local voltage

9. 8. Shutdown equipment/machinery

All major shutdown events require a formally documented plan. The various types of units used in different industries have differences that affect operation. The procedures outlined in this section are generic and may not apply to all types of equipment.

The types of shutdowns used are:

a. Scheduled shutdown

A scheduled shutdown is initiated by the operator during normal operation of the unit when:

- maintenance is required or
- Feed supply is low or exhausted.

The shutdown procedure will depend on the type of equipment and the process chemistry. Some steps taken in a unit shutdown may include:

- shutting off the feeds to stop processes and heat generation particularly if processes are exothermic (produce heat)
- recirculating feeds from supply tanks so they do not enter the unit
- shutting off heating or cooling to the unit or feed preheat system
- shutting off mixing and other mechanical operations
- cooling and flushing materials from the unit

b. Maintenance shutdown

❖ When maintenance to the unit equipment is required, the equipment may need to be entered so that work can take place.

❖ The shutdown should be a scheduled or planned shutdown as per Standard Operating Procedures where equipment is:

- isolated (process, mechanical and electrical)
- cooled and depressurized
- purged and gas freed
- cleaned gas tested on a continuous basis prior to and during entry.

A planned unit shutdown will prevent:

- plugging of lines or equipment
- possible damage to equipment
- Possible injury.

c. Emergency shutdown

- An emergency shutdown is initiated in the event of a fire, major spill, instrument failure, power failure, or total loss of control of chemical or physical processes.
- Emergency shutdown procedures must be followed during a shutdown sequence.

Self-Check -9	Written Test

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

1. Describe the Environmental issues considered specific to meat processing during work (4pts)
2. Indicate the work flow steps in MPP industry and try to indicate the relationship with work place (10pts)

Note: **Satisfactory rating – 14 points** **Unsatisfactory - below 14 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1_____

_____

_____

Information sheet -10. Notifying relevant personnel of setup completion

As described in the past learning guides, a person who is untrained on the machine should not be allowed to operate any machine. Up on completion of any production/ processing line set up by the operator or person assigned to set it up, it is very important to notify the relevant personnel/supervisor about the completion of setup.

This can be approved by Completion Criteria: The checklist is marked completed automatically if it meets the specified criteria. So that the select a criterion to determine when the checklist will be marked complete:

- All mandatory tasks completed like setting, installing, adjusting, leveling, and identifying damaged and wear of valves and fittings and maintenance etc
- All mandatory and optional tasks completed so that it is ready to use.

Self-Check -10	Written Test

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

1. Describe the condition in which notification of set up completion to the relevant personnel is required? (4pts)

Note: **Satisfactory rating – 14 points** **Unsatisfactory - below 14 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1

- _____
- _____
- _____

Operation sheet 1.	Selecting or adjusting machine settings

Procedures

1. Prepare all necessary materials and equipment
2. Produce the first item
3. Adjust the machine or make a correction in setting
4. Observe the difference between the desired level and the measured value of the first item.
5. See the result and if greater than adjusted then decrease the size of the next item, and vice versa.
6. After making adjustment and producing the second item,
7. Make a correction in level of the machine equivalent to only one-half of the difference between the desired level and the measurement of the second item.
8. Produce the n^{th} item the correction or adjustment to be made should be 1/n of the measured deviation of that item from the desired level.
9. follow this procedure to guaranteed that the true mean level
10. Extend the activity to groups of items.
11. Record your finding and report to your instructor /supervisor.

Operation sheet 2	chopping meat by small or medium scale meat processors

Methods used for processing:

Step 1: prepare the necessary materials

Step 2: pre-minced lean meat portion and kept chilled (0˚C).

Step 3: place it in the bowl cutter with the salt and additives for the whole batch. Chop mixture is for 5-10 rounds without ice.

Step 4: add ice and continue chopping until the ice is evenly incorporated and a “sticky” lean batter is achieved.

Step 5. Add also the spices

Step 6: add the fat (pre-minced and chilled) and chop at high speed by mixture to achieve homogeneous batter made of lean and fatty tissues

Step 7: keep the final temperature of the batter should not exceed +12°C

Step 8 Pass the batter through emulsifying machines

Step 9 record and report your finding

Operation sheet 3	Packaging of fresh meat for short term storage

Procedures

Step 1. Prepare the necessary materials for use and safety

Step 2: wrap fresh meat in polyethylene pouches or bag.

Step 3: wrap fresh meat cuts using polyproplylene, polyvenylidine chloride or cellophane films

Step 4: wrapped in shrink film then immerse in hot water (90°C) for a few seconds

Step 5: Conclude your task and report it.

Operation sheet 4	Shutting down machineries

Steps

1. Prepare all necessary materials and equipment
2. shut off the feeds to stop processes and heat generation particularly if processes are exothermic (produce heat)
3. recirculate feeds from supply tanks so they do not enter the unit
4. shut off heating or cooling to the unit or feed preheat system
5. shut down mixing and other mechanical operations
6. cool and flush materials from the unit
7. report the result to your supervisor/ trainer

LAP Test	Moisture content determination

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Use personnel protective equipment,

Given necessary templates tools and materials you are required to perform the following tasks within **5** hours.

Task1: Perform adjusting machine settings

Task2: conduct meat chopping

Task3: Perform Packaging of fresh meat for short term storage

Task4: conduct Shutting down machineries

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This TTLM was developed on March 2021 at Bishoftu, Ethiopian Management Institute

Trainers prepared the TTLM with their full address

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Answer key for M20 production/ packaging line set up

LO1.

Self- check 1

1.

- Casing filling material
- Weighing scale/sensitive balance
- Deboning area and material.
- Apron
- Screw drive
- Shoe drier
- Holding create
- hanging hooks
- cart
- grinder
- Mesh glove

2. cooking knife, curving knife, utility knife, filleting knife, boning knife, shaping knife, pleating knife, meat cleaver knife, breast knife, turning knife, kitchen knife

Self- check 2

1.

a. **Meat grinder (mincer)** used to force meat or meat trimmings by means of a feeding worm (auger) under pressure through a horizontally mounted cylinder (barrel).
b. **Bowl cutter (bowl chopper):** Meat chopping equipment designed to produce small or very small lean meat and fat particles.
c. **Piston stuffer:** Used for filling all types of meat batter in casings, glass jars, Cans, etc.
d. **Clipping machine:** Small aluminum sealing clips the sausage ends
e. **Smokehouses:** Tradition and small –scale operation
f. **Vacuum packaging machine:** Meat product placed in vacuum bag.

Self-check 3.

1. Issues like physical layout, basic services or installations and equipment must thus be taken into account.

Self-check 4.

1. E 2. C

LO2

Self-check 1

1. B

2.

- To reduce the risks from food hazards-food poisoning and foreign body contamination
- To comply with local and international legislation
- To meet specific customer requirements.
- To meet the requirements of global food safety standards (GFSI)
- To maintain positive audit and inspection outcomes
- To allow maximum plant productivity
- To present a hygienic visual image
- To promote safe working conditions for staff, contractors and visitors
- To maintain product shelf-life
- To avoid pest infestation

Self-check 2

1.

- Draw attention to the presence of any immediate danger - other items can await the final report.
- Shut down and "lock out" any hazardous items that cannot be brought to a safe operating standard until repaired.
- Do not operate equipment. Ask the operator for a demonstration
- And others

2.

- what to look at
- what to look for
- what to do if they find a problem

3.

To identify whether work equipment can be operated, adjusted and maintained safely, with any deterioration detected and remedied before it results in a health and safety risk.

Self-check 3

1.

1. Forget output, focus on profits
2. End the annual review
3. Rethink teamwork
4. Recognize process rather than results
5. Take a lesson from gamers.

-

2. It is well known fact that for a given or constant setting, a machine or process will turn out items or piece parts which exhibit variation.

Self-check 4

1

- to maximize the packaging impact on extending product shelf life,
- reducing footprint from both packaging and product and
- providing correct end of life for recycling, reusing, or disposing.

2. This includes an assessment of

- technical capabilities,
- labor requirements,
- worker safety, maintainability serviceability,
- reliability , ability to integrate into the packaging line,
- capital cost,
- floor space,
- Flexibility (change-over, materials, multiple products, etc.),
- energy requirements,
- quality of outgoing packages,
- qualifications (for food, pharmaceuticals, etc.), throughput,

- efficiency, productivity,
- ergonomics,
- Return on investment, etc.

3. D

Self-check 5

1.

- OEE is a management tool that addresses multiple issues with production by gathering data points that can provide critical information about your manufacturing process.
- Performance takes into account anything that causes the manufacturing process to run at less than the maximum possible speed when it is running (including both Slow Cycles and Small Stops).

2.

- **OEE = Availability x Performance x Quality**
- **Performance = (Ideal Cycle Time × Total Count) / Run Time OR**
- **Performance = (Total Count / Run Time) / Ideal Run Rate**

Self-check 6

1.

- Mechanical hazards
- Electrical hazards
- Other hazards
- Protective equipment
- Maintenance and repair
- Safeguards
- Training

2. Employees can identify small problems before they become big ones. One more important benefit of Pre-Start Checks is

3. that the inspection uncovers defects that might cause damage to the equipment if it is started.

Self- check 7.

1.

- Creating a schedule and start-up budget that includes training, testing, and start-up dates.
- Arranging for start-up assistance with major equipment suppliers.
- Obtaining initial supplies and spare parts and confirming availability during start-up.

Self- check 8.

1. **From check list**

Self- check 9.

1. Environmental issues specific to meat processing may include the following

- Solid waste and by-products
- Wastewater
- Emissions to air
- Resource consumption

Self- check 10.

1. When All mandatory tasks completed like setting, installing, adjusting, leveling, and identifying damaged and wear of valves and fittings and maintenance etc