# Oil Seed and Pulse Processing

# Level II

## Based on October 2019, Occupational standards (OS) Version 2

**Module Title: Operating Extrusion Process**

**LG Code: IND OSP2 M12 LO (1-3) LG (38 - 40)**

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**Instruction sheet**

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

- Confirming available materials
- Identifying cleaning and maintenance requirements
- Confirming different services
- Fitting and adjusting machine components and related attachments
- Entering operation of equipment and processes
- Checking and adjusting extrusion equipment performance
- Carrying out Pre-start checks
- Legislative requirements of extrusion process
- Occupational Health and Safety (OHS) hazards

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 available materials
- Identify cleaning and maintenance requirements
- Confirm different services
- Fit and adjust machine components and related attachments
- Enter operation of equipment and processes
- Check and adjust extrusion equipment performance
- Carry out Pre-start checks
- Legislative requirements of extrusion process
- Occupational Health and Safety (OHS) hazards

| **Learning Instructions:** |
| --- |
| 1. Read the specific objectives of this Learning Guide.<br>2. Follow the instructions described below.<br>3. Read the information written in the information Sheets<br>4. Accomplish the Self-checks |

## Information Sheet 1 - Confirming available materials

### 1.1 Introduction

Extrusion is simply the operation of shaping aplastic or dough-like materials by forcing it though a restriction or die. Extruders are mechanical devices in which a feed material is transported by a screw rotating within a closed barrel under varying conditions of heat, shear, and pressure and then discharged through die openings in the optimal geometry for the desired product. These machines are used in processing food (e.g., snack foods and breakfast cereals), feed (e.g., pet food), and industrial products (e.g., plastics).

### 1.2 Confirming available materials

In practice, processors define their requirements in terms of raw material specifications for any process on arrival at the factory gate. Acceptance of, or price paid for the raw material depends on the results of specific tests. Oil seed deliveries would be routinely tested for:

- Hygienic quality,
- Antibiotic residues,
- Moisture content (9 -13%)
- Oil and protein content.

Materials which are used in oil seed processing include:

- Cracked oil seed

The grade specifications of different oilseeds are based on:

- Quantity of non-prime seeds including damaged, insect-infested seeds, slightly damaged seeds, shriveled and immature seeds,
- Type and quantity of impurities or foreign matter,
- Moisture content of seeds,
- Oil content, and color,
- Acid value,
- Iodine value and other indices of quality of extracted oil.

| Self-Check 1 | Written Test |
|---|---|

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

1. Define extrusion process (5 point)
2. What are the tests that will be conducted in oil seed deliveries (5 point)
3. What are the grade specifications in which different oilseeds abased? (5 point)

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

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

## Information Sheet 2- Identifying cleaning and maintenance requirements

### 2.1 Introduction

Normally, the oil seeds are mixed with a variety of foreign materials with, sand, stones, stalks, weed seeds, foilage, etc., during harvesting, handling and transportation. It is ideal to clean seed before putting it into store. Stone, iron and wood pieces mixed with seeds can disrupt mechanical equipment during processing. Foreign matters may lower protein content and increase fibre content of meal residue after extraction of the oil. Moreover, foreign matters mixed with oilseeds may be having high moisture content which may initiate overheating in storage. The local hot spots in the oilseed damage the quality and constitute a fire hazard if not properly detected and corrected by aeration or rotation. Also, cleaning before storage of oils not required further cleaning for processing and saves double handling of seeds. In short, proper cleaning of oilseeds can increase in crushing capacity of oil expelling units, reduce in-plant maintenance and improve the quality of oil and cake.

### 2.2 Identifying cleaning and maintenance requirements

#### 2.2.1 Raw Material Cleaning

Cleaning is a process which will remove soil and prevent accumulation of food residues which may decompose or support the growth of disease causing organisms or the production of toxins. All food raw materials are cleaned before processing. The purpose is obviously to remove contaminants, which range from innocuous to dangerous. It is important to note that removal of contaminants is essential for protection of process equipment as well as the final consumer. For example, it is essential to remove sand, stones or metallic particles from oil seed prior to milling to avoid damaging the machinery. The main contaminants of raw materials are:

- Unwanted parts of the plant, such as leaves, twigs, husks;
- Soil, sand, stones and metallic particles from the growing area;
- Insects and their eggs;
- Animal excreta, hairs etc.;

- Pesticides and fertilizers;
- Mineral oil;
- Microorganisms and their toxins.

Cleaning is essentially separation in which some difference in physical properties of the contaminants and the food units is exploited. There are a number of cleaning methods available, classified into dry and wet methods, but a combination would usually be employed for any specific material. Selection of the appropriate cleaning regime depends on the material being cleaned, the level and type of contamination and the degree of decontamination required**.**

### 2.2.1.1 Types of Cleaning

- **Dry Cleaning Methods**

The main dry cleaning methods are based on screens, aspiration or magnetic separations. Dry methods are generally less expensive than wet methods and the effluent is cheaper to dispose of, but they tend to be less effective in terms of cleaning efficiency. A major problem is recontamination of the material with dust. Precautions may be necessary to avoid the risk of dust explosions and fires. Screens are essentially size separators based on perforated beds or wire mesh. Larger contaminants are removed from smaller food items: e.g. straw from cereal grains, or pods and twigs from peas. This is termed ‘scalping’, see Fig. 1. a. Alternatively, ‘dedusting’ is the removal of smaller particles, e.g. sand or dust, from larger food units, see Fig. 1. b.

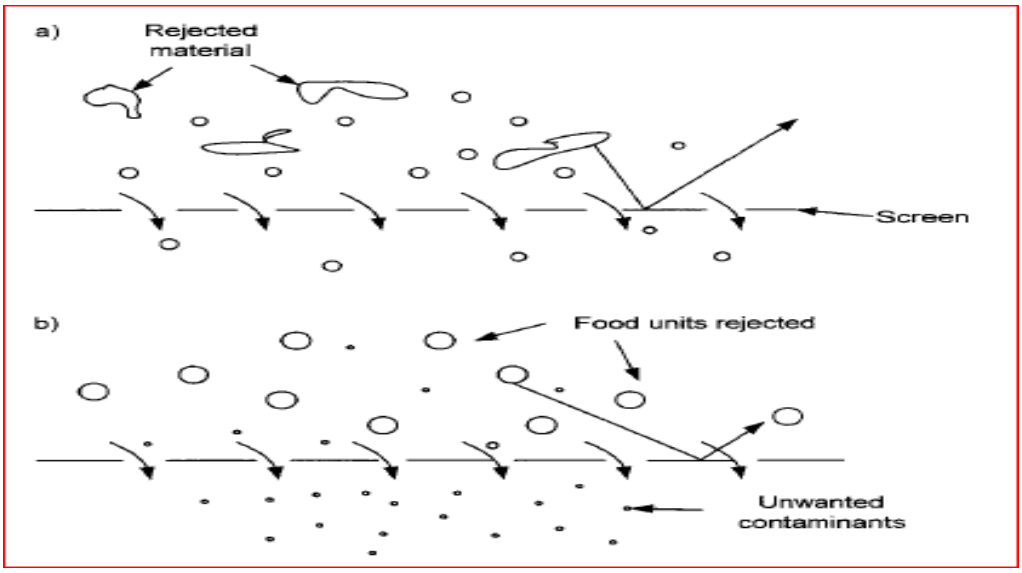


**Figure 1**. Scalping and Dedusting

- ✓ **Magnetic cleaning**

Magnetic cleaning is the removal of ferrous metal using permanent or electromagnets. Metal particles, derived from the growing field or picked up during transport or preliminary operations, constitute a hazard both to the consumer and to processing machinery, for example cereal mills. The geometry of magnetic cleaning systems can be quite variable: particulate foods may be passed over magnetized drums or magnetized conveyor belts, or powerful magnets may be located above conveyors. Electromagnets are easy to clean by turning off the power. Metal detectors are frequently employed prior to sensitive processing equipment as well as to protect consumers at the end of processing lines.

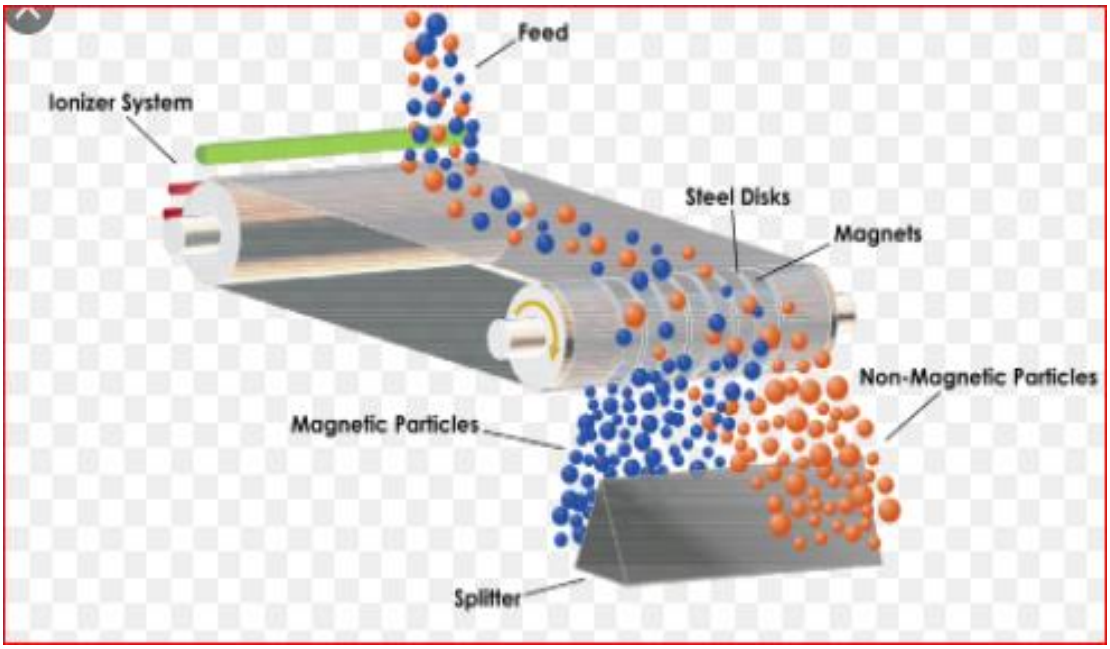


**Figure 2. Magnetic cleaning**

- ✓ **Electrostatic cleaning**

Electrostatic cleaning can be used in a limited number of cases where the surface charge on raw materials differs from contaminating particles. The principle can be used to distinguish grains from other seeds of similar geometry but different surface charge; and it has also been described for cleaning tea. The feed is conveyed on a charged belt and charged particles are attracted to an oppositely charged electrode (see Fig.3) according to their surface charge.

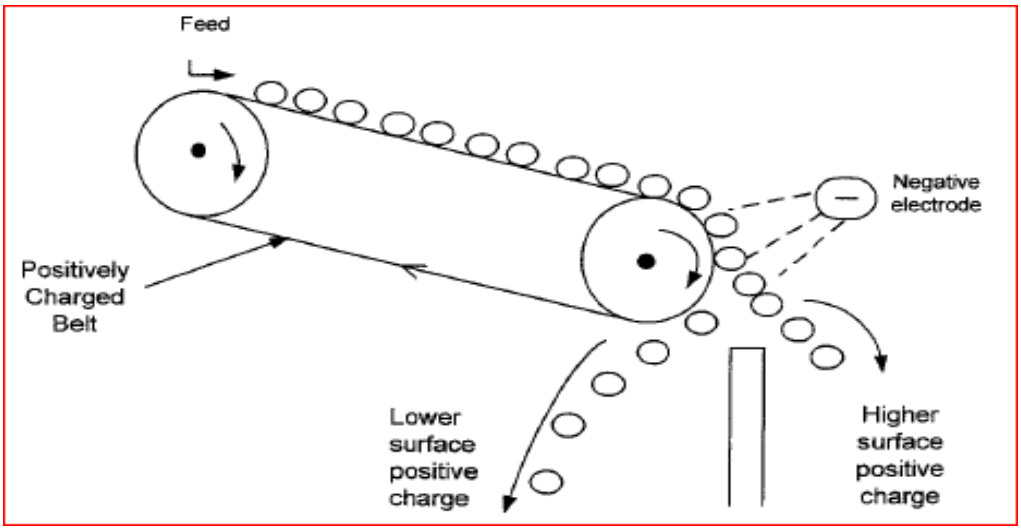


**Figure 3. Electrostatic cleaning**

- **Wet Cleaning Methods**

Wet methods are necessary if large quantities of soil are to be removed; and they are essential if detergents are used. However, they are expensive, as large quantities of high purity water are required and the same quantity of dirty effluent is produced. Treatment and reuse of water can reduce costs. Employing the countercurrent principle can reduce water requirements and effluent volumes if accurately controlled. Sanitizing chemicals such as chlorine, citric acid and ozone are commonly used in wash waters, especially in association with peeling and size reduction, where reducing enzymic browning may also be an aim. Levels of 100–200 mg chlorine or citric acid may be used, although their effectiveness for decontamination has been questioned and they are not permitted in some countries.

✓ **Soaking**

Soaking is a preliminary stage in cleaning heavily contaminated materials, such as root crops, permitting softening of the soil and partial removal of stones and other contaminants. Metallic or concrete tanks or drums are employed; and these may be fitted with devices for agitating the water, including stirrers, paddles or mechanisms for rotating the entire drum. For delicate produce such as strawberries or asparagus, or products which trap dirt internally, e.g. celery, sparging air through the system may be helpful. The use of warm water or including detergents improves cleaning efficiency, especially where mineral oil is a possible contaminant, but adds to the expense and may damage the texture**.**

✓ **Spray washing**

Spray washing is very widely used for many types of food raw material. Efficiency depends on the volume and temperature of the water and time of exposure. As a general rule, small volumes of high pressure water give the most efficient dirt removal, but this is limited by product damage, especially to more delicate produce. With larger food pieces, it may be necessary to rotate the unit so that the whole surface is presented to the spray. The two most common designs are drum washers and belt washers (see Fig4. a, and b). Abrasion may contribute to the cleaning effect, but again

must be limited in delicate units. Other designs include flexible rubber discs which gently brush the surface clean.

- ✓ **Flotation washing**

Flotation washing employs buoyancy differences between food units and contaminants. For instance sound fruit generally floats, while contaminating soil, stones or rotten fruits sink in water. Hence fluming fruit in water over a series of weirs gives very effective cleaning of fruit, peas and beans. A disadvantage is high water use, thus recirculation of water should be incorporated. Froth flotation is carried out to separate peas from contaminating weed seeds and exploits surfactant effects. The peas are dipped in an oil/detergent emulsion and air is blown through the bed. This forms a foam which washes away the contaminating material and the cleaned peas can be spray washed. Following wet cleaning, it is necessary to remove the washing water. Centrifugation is very effective, but may lead to tissue damage, hence dewatering screens or reels are more common.

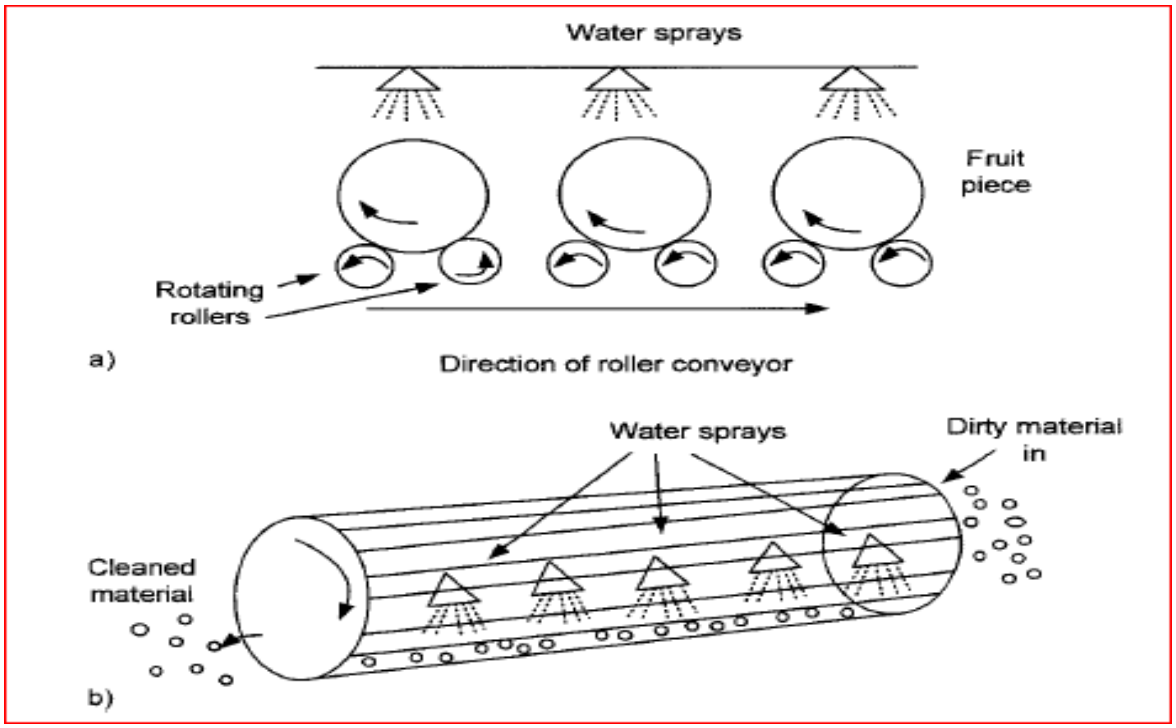


**Figure 4. Water spray cleaning: (a) spray belt washer, (b) drum washer.**

| Self-Check 2 | Written Test |
|---|---|

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

1. Define Cleaning (5 point)
2. What are the main contaminants of raw materials? (5 point)
3. Write and explain the two types of cleaning (10 point)

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

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

**Information Sheet 3 - Confirming different services**

## 3.1 Confirming different services

All services or utilities that could impact on product quality and process (e.g. steam, gases, compressed air, and heating, ventilation and air conditioning) should be qualified and appropriately monitored and action should be taken when limits are exceeded. Different services which are needed in oil seed processing may include but not limited to:

- power
- steam
- compressed and instrumentation air

✓ **Electric power**

Electric power is the most important in any processing industry. Without electric power it is impossible to operate or produce any product using machine. It provides energy to operating equipments and machines which helps to process the feed raw materials in to new products. If power shortage happen during processing, it may cause many damages to raw materials, product and machine.

✓ **Steam**

Steam is water in the gas phase. It is commonly formed by boiling or evaporating water. Steam that is saturated or superheated is invisible; however, "steam" often refers to wet steam, the visible mist or aerosol of water droplets formed as water vapour condenses.
It is useful in:

- Clealing ,heat, and cook process of oil seeds
- Clealing of oil processing equipment
- Internal combustion engines and part
- Cleaning floors

✓ **compressed and instrumentation air**

Compressed air is air kept under a pressure that is greater than atmospheric pressure. Compressed air is an important medium for transfer of energy in industrial processes, and is used for power tools such as air hammers, mill, presser and to transfer materials through pipes.

| Self-Check 3 | Written Test |
|---|---|

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

1. Write the services or utilities that could have impact on process and product quality (5pts).
2. Write the uses of electric power in an industry. (5 point)

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

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

**Information Sheet 4- Fitting and adjusting machine components and related attachments**

## 4.1 Introduction

Nowadays the market fluctuation and the fashion ask for more and more new and different patterns, the batch size decreases, it is necessary to design and manufacture with reducing delays best quality products at the lower cost. So the concept of concurrent engineering must be used, it is now well known in industry as well as in academic area. The design of the parts, the process planning, even the production system must be made quite simultaneously**.**

## 4.2 Fitting and adjusting machine components and related attachments

### 4.2.1 Adjustment of machine components

There are four types of machine component adjustment.

#### 4.2.1.1 Functional requirement

Regarding the definition of adjustment, optimal adjustment needs a direct expression of functional requirement. Usually, assembly and positioning are two functional studied requirements having a geometrical expression. The concept of boundary translates cleverly the assembly condition. A part of a mechanism fits all the other parts if none of its manufactured points violates the interchangeability boundary. ISO standard allows to use the Virtual Condition with the Maximum Material Requirement. This condition describes near perfectly the concept of boundary and so the functional requirement of assembly. A manufactured part fits for use if it is entirely on the good side of the interchangeability boundary. A part is all the better since its matter is near the boundary without violating it. Therefore, the deviation, and more exactly, the smallest deviation between the part and the boundary evaluates numerically the respect of the function.

#### 4.2.1.2 Manufacturing deviations, adjustment parameters and measurement

Adjusting a machine tool demands to connect the active part of the tool with the machined surface. This work does not succeed at the first time because there are a lot of errors or uncertainties due to the adjustment operation and the machining process as well as the static or dynamic behavior of the machine tool, the tool or the work piece.

Those uncertainties are the causes of manufacturing deviations. To control the influence of some uncertainties as screw, displacement reversibility or slide way defects, machine-tool builder put some adjustment parameters into the numerical control unit or adjustable stops on conventional machine tool. The modification of these parameters allows to moving the uncertainty zone compared with its nominal position. The dimension of this displayed quantity (adjustment parameter) is the length, and diameter. In return, the dimension of machined quantity is more complicated, it assures the respect of the functional requirement. So in practice, for adjustment correction, these requirements must be translate into a dimension compatible with a length (dimension of displayed quantity). Therefore, the aim of the measurement task is to evaluate the respect of the function and to give a measured quantity compatible with the adjustment parameters. The difference between displayed quantity and measured quantity gives the value of the correction of the adjustment parameter**.**

#### 4.2.1.3 Adjustment model for the determination of the correction

We define a model built on a geometrical representation of the interchangeability boundary. Variation of some dimensions, which correspond to adjustment parameters, allows to distort the model. They allow to fit at best adjustment model to the geometry given by the measurement of first (or a couple of) manufactured part on the coordinate measuring machine for example. After moving and distorting of the model, the variations of dimensions give directly the value of the corrections of the adjustment parameters. Therefore, after having introduced these corrections, the following manufactured part has more chances to fit at best the interchangeability boundary and consequently the functional requirement.

#### 4.2.1.4 Geometric adjustment method

To explain the proposed method, we use an application that is quite representative of the industrial adjustment problem. Its first function is to respect an assembly condition: when the cover lies on the A plan and when a shaft goes through the cylinder, two screws have to fit with the part. The cover is manufactured on a conventional machine tool, it lies on the A plan, a drilling tool drills both holes with a diameter of 12.5 mm. A boring tool finishes the diameter of 28 mm. Three adjustable longitudinal stops put each tool in its work position. The machine gives the other cross- position and the direction of drilling. There is no difference with a numerical machine tool; just we deal with numerical.

| Self-Check 4 | Written Test |
|---|---|

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

1. Write the four types of machine component adjustment (5pts).

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

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

**Information Sheet 5 - Entering operation of equipment and processes**

## 5.1 Entering operation of equipment and processes

There are several ways to control and minimize measurement errors. The most immediate approach to control measurement errors is to buy more precise and expensive measurement equipment and hire/train personnel that are more competent. In the figure below operators are entering the processing parameters into the oil seed processing extruder by pressing parameter keys on the extruder boards. Entering of the correct operation of equipment and processes in processing industry are the basic activities that helps to maintain the equipments and process within the specified parameters. During performing this activities, it is mandatory to take care of that the weither we entered the correct parameters or not.

The importance of entering the correct parameters are:

- It helps the machine and equipments function correctly.
- It helps to obtain quality product
- It minimize the risk of hazards
- Increase the life of equipment

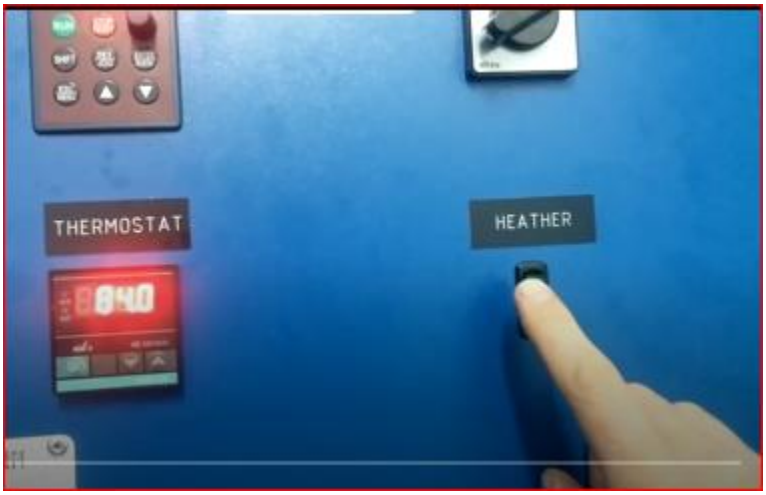


**Figure 5.** Control unit on extruder

**Notice:** For more clarification watch this **video**

| Self-Check 5 | Written Test |
|---|---|

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

1. Write the importance of entering the correct parameters (5pts).

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

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

| Information Sheet # 6 | Checking and adjusting extrusion equipment performance |
|---|---|

## 6.1 Introduction

Capacity can be defined as “the amount that can be produced”. From a discrete manufacturing perspective, we can define capacity as “the maximum number of parts that can be manufactured”. 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 (p) sometimes referred to as Efficiency, is a measure of how good the machine runs while it is running (within the operating time). Utilization can be defined as “how much something is used”.

Performance = Pieces Produced / (Ideal Speed * Operating Time) * 100%

- Pieces Produced = unplanned scrap PLUS acceptable pieces.
- Ideal Speed = optimal speed the part should run on the machine.
- Operating Time = Planned Production Time - Planned Downtime

Performance should never be greater than 100%.

## 6.2 Checking and adjusting extrusion equipment performance

### 6.2.1 Overall Equipment Effectiveness(OEE)

OEE is a measurement used in programs. The measure includes machine effectiveness and efficiency and is a metric commonly found in. It helps answer three questions:

- How often is the machine available to run?
- How fast does it run when it's running?
- How many acceptable parts were produced?

The simplest way to calculate OEE is as the ratio of Fully Productive Time to Planned Production Time. Fully Productive Time is just another way of saying manufacturing only Good Parts as fast as possible (Ideal Cycle Time) with no Stop Time. Hence the calculation is:

OEE = (Good Count × Ideal Cycle Time) / Planned Production Time

### 6.2.2 Total Effective Equipment Performance (TEEP)

Total Effective Equipment Performance (TEEP) is a performance metric that provides insights as to the true capacity of your manufacturing operation. It takes account both Equipment Losses (as measured by OEE) and Schedule Losses (as measured by Utilization). TEEP is calculated by multiplying four factors: Availability, Performance, Quality, and Utilization.

- OEE measures the percentage of Planned Production Time that is truly productive.
- TEEP measures the percentage of All Time that is truly productive.

TEEP is calculated as:

TEEP = OEE × Utilization

Utilization is calculated as:

Utilization = Planned Production= Time / All Time

Here is a simple example, based on a manufacturing operation with a 65% OEE score, that is running two 8-hour shifts per day, five days per week.

**Table 1.**Calculations for TEEP

| **Item** | **Value** | **Calculation** |
|---|---|---|
| OEE | 65.00% | How to calculate OEE |
| Planned Production Time | 80 hours | 8 hours × 2 shifts × 5 days |
| All Time | 168 hours | 24 hours × 7 days |
| Utilization | 47.62% | 80 hours / 168 hours |
| TEEP | 30.95% | 0.6500 × 0.4762 |

| Self-Check 6 | Written Test |
|---|---|

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

1. Define Effective Equipment Performance (TEEP)(5pts )
2. Write the formula for performance (5pts)

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

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

## Information Sheet 7- Carrying out Pre-start checks

### 7.1 Introduction

In an industry, there are many types of works to be operated using different machine and equipment. So before we are going to operate machine/lab equipment we have to inspect /check whether it was in a good operating condition or not. Before allowing someone to start using any machine you need to think about what risks there are and how these can be managed. So, you should:

- Check that it is complete, with all safeguards fitted, and free from defects. The term 'safeguard' includes guards, interlocks, two-hand controls, light guards, pressure-sensitive mats etc. By law, the supplier must provide the right safeguards and inform buyers of any risks ('residual risks') that users need to be aware of and manage because they could not be designed out.
- Produce a safe system of work for using and maintaining the machine. Maintenance may require the inspection of critical features where deterioration would cause a risk. Also look at the residual risks identified by the manufacturer in the information/instructions provided with the machine and make sure they are included in the safe system of work.
- Ensure every static machine has been installed properly and is stable (usually fixed down) and is not in a location where other workers, customers or visitors may be exposed to risk.
- Choose the right machine for the job.
- Safe for any work that has to be done when setting up, during normal use, when clearing blockages, when carrying out repairs for breakdowns, and during planned maintenance;
- Properly switched off, isolated or locked-off before taking any action to remove blockages, clean or adjust the machine.

## 7.2 Carrying out Pre-start checks

Pre-start checks on machinery and equipment in used for oil seed extrusion process are:

- Inspecting equipment condition (signs of wear)
- Selecting appropriate settings and/or related parameters
- Cancelling isolation or lock outs as required
- Confirming that required screens are fitted and related equipment is clean and correctly configured as per cleaning process requirements
- Positioning sensors and controls correctly
- Ensuring any scheduled maintenance has been carried out
- Confirming that all safety guards are in place and operational
- Check that equipment is plugged in correctly
- Ensure that the electrical cords are in good condition and not frayed or broken.
- Start equipment in accordance with the organizations or manufacture's guidelines.
- Use safety guards or safety clothing (if applicable). Some equipment can have areas that can cause injury such as cutting blades and overheated areas.

## 8.1 Pre-operational checks of equipment

Pre-operational checks of equipment include:

- Pre-start and safety checks including the service and maintenance system.
- Checking size of sieve, type machine with respective oil seed type, fuel, and lubricants needed, fan belts, lines, connections and transmission.
- Inspection of safety guards
- Checking and confirming equipment calibration settings and operating methods
- Observing and monitoring noise levels for correct operation.
- Preparation of independently powered tools may include cleaning, priming, tightening, basic repairs and adjustments.
- Identify and segregate unsafe or faulty equipment for repair or replacement.

| Self-Check 7 | Written Test |
|---|---|

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

3. What you have to do during conducting pre-start checks on an equipments? (5pts )

4. Write the pre-operational checks of equipment (5pts)

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

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

## Information Sheet 8 - Legislative requirements of extrusion process

### 8.1 Legislative requirements of extrusion process

May include but not limited to:

- Ethiopian Food Standards Code,
  - ✓ mandatory oil seed standards, edible oil standards, labelling
  - ✓ Weights and measures legislation
  - ✓ Ethiopian Food and Drug Authority) legislation
- Environmental management (Ethiopian Environmental Protection Authority)
- OHS, anti-discrimination and equal opportunity

### 8.2 Mandatory oil seed and edible oil standard

#### 8.2.1 Mandatory oil seed and edible oil standard

Ethiopian legislative requirements for mandatory oil seed standards, edible oil standard are listed below in the table.

**Table 2. Mandatory oil seed and edible oil standard**

| No | Product | Ethiopian Standard Number | Ethiopian Standard Title |
|---|---|---|---|
| 1. | Oil seeds | CES 05-2013 | Oil Seeds-Specification |
| 2. | Oil seeds | CES 06-2013 | Oil Seeds Method Of Packaging |
| 3. | Edible oil additives | CES 12-2013 | Edible Oils-Specification For Additives |
| 4. | Edible Vegetable oil | CES 21-2013 | Edible Vegetable Oils-Packing |
| 5. | Edible groundnut oil | CES 16-2013 | Groundnut (Peanut) Oil-Specification |
| 6. | Sunflower seed oil | CES 17-2013 | Sunflower Seed Oil- Specification |
| 7. | Edible cottonseed | CES 19-2013 | oil Cottonseed Oil-Specification |
| 8. | Edible linseed oil | CES 18-2013 | Linseed Oil-Specification |
| 9. | CES15-2013 | Edible sesame seed oil | Sesame Seed Oil– Specification |

### 8.2.2 Mandatory packaging and labeling standard

In accordance with the Ethiopian Food, Medicine and Healthcare Administration and Control Authority Proclamation No. 661/2009, “packaging material shall be made out of substances, which are safe and suitable for their intended use, and the product shall be packed in container which will safeguard its hygienic, safety, quality and food grade.” Further, the Proclamation states that “no packaging material shall be put into use unless it complies with the international and national safety and quality standards.” Individual product standards may also contain additional guidance and/or requirements as it relates to packaging and container requirements. As an example, the standard for food products indicates the following packing requirements, such as:

- Name of the food
- Nutrition content
- List of ingredients (except for single ingredient foods) in descending order of weight
- List of minerals or vitamin supplements added to fortify foods (if needed)
- List of ingredients that may cause an allergic reaction
- Net weight or volume of contents
- Name and address of the manufacturer, packer, distributor, importer, exporter or vendor
- Country of origin
- Production and expiration dates (Note: Food products must have at least 50 percent of their shelf life remaining when they arrive at customs. Expired food cannot enter the country not can it be sold in the marketplace. Certain foods are exempt from carrying expiry dates, including fresh fruits and vegetables, wines, beverages with 10 percent alcohol by volume, vinegar and chewing gum.)
- Code identifying producing factory and lot
- Instructions for use (if needed)
- For beverages containing more than 1.2 percent alcohol, the alcohol proof is required on the label.

- GM foods must carry the label with the following statement: 'genetically modified food'.

Required Labeling Elements for Raw Foods:

- Name
- Ingredient list
- Net content
- Name and address of the producer and/or importer
- Country of origin
- Lot identification
- Expiry date or minimum useful life
- Conditions for product storage

### 8.2.3 Weights and measures legislation

The Standards of Weights and Measures, enforces uniform standards of weights and measures, based on the metric system. Based on the suggestions of General Conference of Weights and Measures (CGPM), International Organization of Legal Metrology (OIML), the 1956 act was replaced by a comprehensive legislation, The Standards of Weights and Measures are administered by the ministry of Consumer affairs, Food and Public Distribution.

### 8.2.4 Ethiopian Food and drug Authority (EFDA) legislation

The country's food safety regulatory system is authorized and mandated in Parliamentary Proclamation Ethiopian Food, Medicine and Healthcare Administration and Control Authority Proclamation No. 661/2009. This legislation provided the legal authorities for the government to consolidate the pre-existing food regulatory system with the aim of better 'protecting the public from health risks emerging out of unsafe and poor quality food.' In particular, the Proclamation authorizes the setting of standards and regulations for locally-produced and imported foods, in areas such as production, promotion, storage, packaging and labeling, distribution, and laboratory testing. In a subsequent Parliamentary Proclamation Ethiopian Food, Medicine and Healthcare Administration and Control Authority Regulation No. 189/2010 the Food, Medicine, Healthcare and Control Authority (FMHACA) was established, under the purview of the

Ministry of Health, as the competent authority responsible for setting and enforcing food safety standards and regulations. Under this proclamation, food is defined as “any raw, semi-processed or processed substance for commercial purpose or to be served for the public in any way intended for human consumption that includes water and other drinks, chewing gum, supplementary food and any substance which has been used in the manufacture, preparation or treatment of food.”

### 8.3 Environmental management (Environmental Protection Authority)

The Establishment of the Federal Environmental Protection Authority (EPA) by proclamation No. 9/1995 has been the most important step in setting up the legal framework for the environment in Ethiopia at the federal level. The EPA has a well-established organizational structure with a technical department in place concerning EIA. The accountability of EPA for the administration of environmental protection at the federal level is exclusive with environment matters

### 8.4 Occupational Health Safety , anti-discrimination and equal opportunity

Under both pieces of legislation, it is the legal duty of the employer to ensure that the workplace is free from discrimination and harassment. In a recent decision, it was insufficient for an employer to simply explain employees' rights and confirm a policy of equal opportunity to avoid blame when allegations of discrimination and harassment arise. Active and material steps have to be taken to create an appropriate work culture. The employer must also ensure that a person is not sexually harassed. In 2011, amendments to the (federal) Sex Discrimination Act 1984 made it unlawful for "a person to sexually harass another in the course of seeking, or receiving, goods, services or facilities from that person". Yet, sexual harassment is prevalent in Australian workplaces. One in four women have experienced harassment at work, and men's harassment of other men is also on the rise. A number of 2013 cases and decisions demonstrated that courts and tribunals will hold employers vicariously liable for the unacceptable conduct engaged in by their employees, and to make orders (including significant amounts of compensation or damages to the employee) against individual harassers, directors and independent contractors whose actions either constitute sexual harassment or otherwise contribute to such harassment taking place. The same could

apply if employers take no action when a client or customer sexually harasses an employee. If you believe you are being discriminated or harassed, take the issue to both the OHS rep and your union delegate. If you are the OHS rep, contact your union for more advice and assistance.

| Self-Check 8 | Written Test |
|---|---|

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

1. Write legislative requirements needed in oilseed processing (4pts )
2. List and write five oil products with its Ethiopian standard number and Ethiopian Standard Title. (5pts )
3. What are the required labeling elements for pre-packaged foods(6pts )

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

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

## Information Sheet 9 - Occupational Health and Safety (OHS) hazards

### 9.1 Introduction

Occupational health and safety is one of the oldest and most advanced social policy areas of the work. OHS is an integral part of everyday work. It is every Public service employee's responsibility to cooperate in practicing sound OHS principles in all work activities established minimum occupational safety and health requirements and stated that "particularly sensitive risk groups must be protected against the dangers which specifically affect them". It includes Information about key health and safety policies, standards of conduct, and associated issues.

### 9.2 Occupational Health and Safety (OHS) hazards

Hazard is a source or situation with the potential for harm in terms of human injury or ill-health, damage to property, the environment, or a combination of these.

Common workplace hazards are; such as:

- Stress
- Fatigue
- Chemicals
- Electrical safety
- Bodily fluids
- Sharps
- Noise
- Work postures
- Manual handling
- Under foot hazards and moving parts of machinery

### 9.3 Hazards control measures

Measures for controlling, eliminate or minimize hazards in accordance with the hierarchy of control includes:

- Elimination (e.g. controlling the hazard at the source)
- Substitution (e.g. replacing one substance or activity at the source)
- Engineering control (e.g. installing guards on machinery)
- Administration control (e.g. policies and procedures for safe work practices)
- Personal protective equipment (e.g. respirators and ear plugs)

### 9.42.5. Safety signs and symbols

Putting Safety signs and symbols in an appropriate area or place also can helps to minimize or reduce hazards that can happen in work areas. Safety signs and symbols include:

- Regulatory signs (e.g. prohibition, mandatory and limitation or restriction)






- Hazard signs (danger and warning)




- Emergency information signs (e.g. exits, equipment, first aid)






- Fire signs (e.g. location of fire alarms and firefighting equipment)




- safety tags and lockout (e.g. danger tags, out of service tags)



- caution signs





| Self-Check 9 | Written Test |
|---|---|

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

1. Write the common workplace hazards (6pts )
2. Write the measures for controlling , eliminate and minimize hazards (5pts )

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

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

| LG # 39 | LO #2 - Operate and monitor the extrusion process |
|---|---|

**Instruction sheet**

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

- Policies and procedures of extrusion process.
- Monitoring extrusion equipment
- Monitoring the extrusions process
- Maintaining the process within specification
- Identifying, out-of-specification product
- Maintaining the work area with the housekeeping standards
- Recording Workplace information requirements.

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

- Policy and procedures of extrusion process.
- Monitor extrusion equipment
- Monitor the extrusions process
- Maintain the process within specification
- Identify out-of-specification product
- Maintain the work area with the housekeeping standards
- Record Workplace information requirements.

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

**Information Sheet 1 - Policies and procedures of extrusion process**

## 1.1 Policies and procedures of extrusion process

Policies and procedures in which you have to follow during extrusion process of oil seeds may include but not limited to:

- Company policies and procedures,
- Regulatory and licensing requirements,
- Legislative requirements, and
- Industrial awards and agreements

### 1.1.1Company policies and procedures

Policies are a statement of purpose, which highlight broad guidelines on action to be taken to achieve that purpose. Policies act as a guiding frame of reference for how the organization deals with everything from its day- to-day operational problems or how to respond to requirements to comply with legislation, regulation and codes of practice. It is important that policies are reasonable, that employees are aware and clearly understand what the policy is trying to achieve. The statement of purpose should not be more than one page in length, but this will vary depending on the policy. Procedures explain how to perform tasks and duties. A procedure may specify who in the organization is responsible for particular tasks and activities, or how they should carry out their duties.

### 1.1.2 Legislative requirements

Legislative Requirements means any applicable law, statute, bye-law, regulation, order, consent, permit, approval, regulatory policy, guidance or industry code, rule of court or directives or requirements of any Regulatory Body, delegated or subordinate legislation or notice of any Regulatory Body. Legislation is law which has been promulgated (or "enacted") by a legislature or other governing body or the process of making it. Before an item of legislation becomes law it may be known as a bill, and may be broadly referred to as "legislation", while it remains under consideration to distinguish it from other business. Legislation can have many purposes: to regulate, to authorize, to

outlaw, to provide (funds), to sanction, to grant, to declare or to restrict. It may be contrasted with a non-legislative act which is adopted by an executive or administrative body under the authority of a legislative act or for implementing a legislative act.

### 1.1.3 Regulatory and licensing requirements

Regulation 5 of the Environmental Protection Regulations 1987 (EP Regulations) specifies that any premises listed in Schedule 1 of the EP Regulations is a prescribed premises.

- **Environmental Protection Regulations**

The following regulations are applicable to all premises, including premises that are not prescribed premises:

- ✓ Environmental Protection (Noise) Regulations 1997; and
- ✓ Environmental Protection (Unauthorized Discharges) Regulations 2004.

The Department also administers regulations that are industry-specific, including:

- Environmental Protection (Abattoirs) Regulations 2001
- Environmental Protection (Abrasive Blasting) Regulations 1998
- Environmental Protection (Concrete Batching and Cement Product Manufacturing) Regulations 1998
- Environmental Protection (Controlled Waste) Regulations 2004
- Environmental Protection (Metal Coating) Regulations 2001; and
- Environmental Protection (Rural Landfill) Regulations 2002.

A licence contains conditions that aim to prevent, control, abate or mitigate pollution or environmental harm as a result of the operation of prescribed premises.

Regulatory and licensing; Act states that the occupier of any prescribed premises who causes or increases, or permits to be caused or increased, an emission, or alters or permits to be altered the nature and volume of the waste, noise, odour or electromagnetic radiation emitted, without holding a licence in respect of those premises commits an offence. A licence ensures there are no unacceptable impacts to the environment or human health.

| Self-Check 1 | Written Test |
|---|---|

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

1. Define policies (4pts )
2. Explain legislative requirements(6pts )

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

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

## Information Sheet 2 - Monitoring extrusion equipment

### 2.1 Introduction

Extruders vary widely in design, function, capabilities, and cost. Oilseed processing and oil extraction processes are designed to obtain high quality oil with minimal undesirable components, achieve high extraction yields and produce high value meal. There are several techniques for extracting oil from oilseeds. Two common oilseed extraction processes are solvent extraction and mechanical extraction using a screw press. Today in the United States, mechanical oil expression is not widely used due to low oil recovery. However, the use of screw press is preferred by small processors because of its low capital cost. Solvent extraction with hexane is the standard practice in today's modern oilseed-processing facilities.

### 2.2 Monitoring extrusion equipment

Oil seed extrusion equipment which are used in oil processing industry may include but not limited to:

- Extruder
- Bin
- Feeder
- Dryer
- Cooler
- Steam injection
- Worm shaft
- Dies
- Mechanical/pneumatic stock transfer equipment

#### 2.2.1Extruder

Food Extruders can be classified by their method of pressure development, positive displacement or viscous drag. Extruders can be classified as single or twin screw based on the design pattern.

- Single screw extruders
- Twin-screw extruders

- **Single screw extruders**

  Single screw Extruders' as represented below are low-cost operative machines designed to use for simple operations such as dry extrusion, simple formulations and on-farm processing of farm ingredients. Operation of these extruders is simple and has been described by Wilson and Tribelhorn. The single screw extruders operate at low moisture and generally autogenous.


**Figure 6**.Extrude

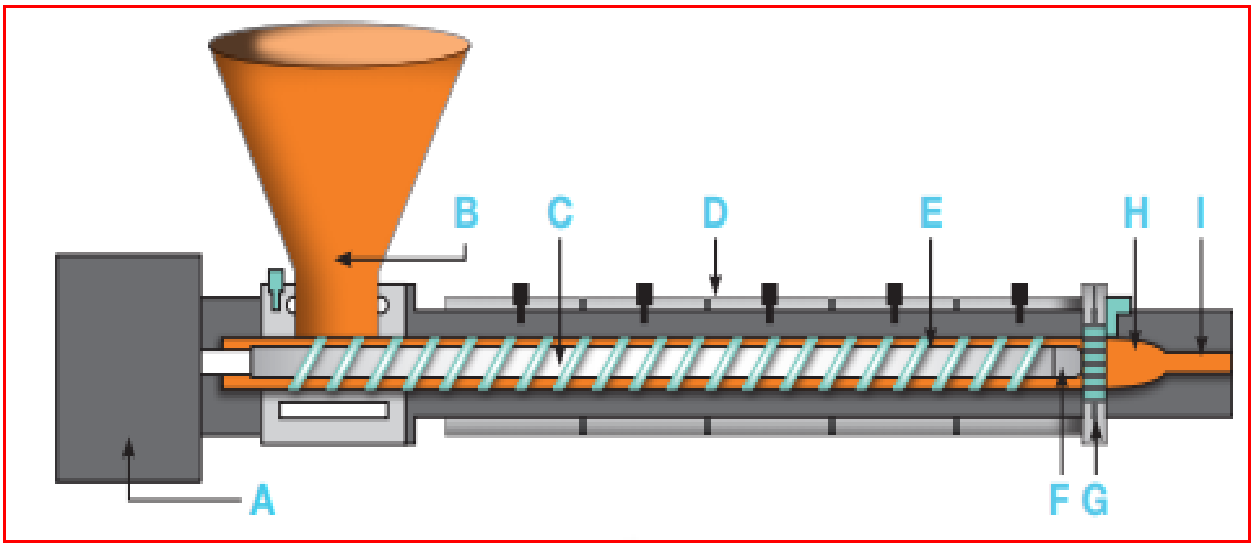


**Figure 7**. Parts of extruder

A – Drive
B - Feed
C – Screw
D - Barrel (heater bands)
E - Barrel Liner
F - Screen Pack
G - Breaker Plate
H - Die Body
I - Die Head

file:///C:/Users/pc/Downloads/LSP%20Extrusion%20Guide.pdf

- **Twin-Screw Extruders**

These extruders have more number of possible configurations giving the way for products to attain different shapes with co-rotating or counter rotating screws. These screws can be either intermeshing or non-intermeshing. The intermeshing can be defined as a gap between the screws where the material flows and compressed. Since the two screws have flight configuration in such a way, that natural steam lock is formed which is independent of the material flow. This formation of natural steam lock makes the extruder to run as a positive pump. The non-intermeshing screws cannot achieve the higher shear as the channels of one or both screws may have open segments. This problem can be overcome using mechanical steam locks. The advantages of twin screw extruders are precise control of product characteristics

extrusion of heat sensitive products reduced volatilization of flavors. Extrusion of ingredients which require additional moisture better mixing characteristics.

**Figure 8** Twin-Screw Extruders

### 2.2.2 Die:

Die is a kind of solid or hollow metal of customized shape that is mainly used in stamping or cutting any shapes or coin, embossing, drawing wires, extruding, press, etc. It is a thing that can be customized according to the requirement or necessity. Along with that, anything from simple to complex shapes can be made through a die.

Diameter of the die influences the shape and texture of the extruded material. Tapered die holes will reduce backpressure requirements and create smoother product surface and cause less damage to the extruded ingredients. Teflon coated inserts are also used to create a smoother surfaced product. The dies can be used in the formation process or casting process and can be termed as Mould. Die is mainly used in the manufacturing departments of industries. The sections of the die, which are made for forming or cutting, can be made of special metal and hardenable steel and it is also known as Tool steel.

**Figure 9. Twin-Screw Extruders**

### 2.2.3 Oil seed dryer

Dryers are used to dry oil seeds to minimize or optimize the moisture content of oil seeds before processing it in to crude oil.

**Figure 10. Twin-Screw Extruders**

### 2.2.4 Steam injection

The steam injection technology is widely used in heavy oil production. The higher the steam injection rate is, the more beneficial the exploitation of heavy oil is. In this paper, we choose the two dimensional rotation axis symmetry model, using VOF model of

steam injection wells, wet steam phase change, transient analysis of influence of different injection pipe string structure in vertical well section during the process of steam injection on steam injection parameters and changes of single and dual steam injection steam injection well bore in steam parameters during the process of steam injection in horizontal wells. The analysis results show that the vertical well steam injection by high vacuum insulated tubing make minimize the dryness of the steam; Toe end dry degree is higher than that of single tube steam injection when horizontal pipe steam injection, which is conducive to the balanced development of heavy oil.

**Figure 11. Twin-Screw Extruders**

### 2.2.5 Cooler

Coolers are used to cool the crude of refined oils before packaging.

**Figure 12.** Cooler

### 2.2.6 Bin

Bins are used to store oil seeds in setting temperature.


**Figure 13. Oil seed storage Bin**

| Self-Check 2 | Written Test |
|---|---|

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

1. Write at list five equipments which are used in oil extrusion process (5 point)
2. What are the main components of oil extruder? (5 point)
3. Write and explain the two types of extruders (10 point)

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

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

## Information Sheet 3 - Identifying out-of-specification product

### 3.1 Identifying out-of-specification product

The main quality checks concern raw materials, processing conditions, product quality and packaging and storage conditions. Raw materials should be checked to ensure that there is no moulds growth, and that they are correctly dried, cleaned and sorted. During processing, the temperature and time of conditioning, the moisture content of the raw material, and the yield of oil should be routinely checked. Quality checks on the product include correct color, flavor, odour, clarity and fill weight. Processed oil should be consistent in all aspects such as:

- Colour,
- Taste and
- Viscosity.

The colour of the oil must be clear and transparent. In addition, the oil should be free of impurities and meet the demands placed upon it for use in cooking. Before being filled, the bottles that hold the oil are cleaned and electronically inspected for foreign material. To prevent oxidation of the oil (and therefore its tendency to go rancid), the inert (non-reactive) gas nitrogen is used to fill up the space remaining at the top of the bottle.

| Self-Check 3 | Written Test |
|---|---|

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

1 What are the consistency indicators of oil products ?(6pts )

2 Why we need to check the quality of raw materials before processing it? (6pts)

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

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

## Information Sheet 4 - Maintaining the process within specification

### 4.1 Introduction

Specification limits describe requirements for products, while acceptance limits are the actual decisive factors in manufacturing. Conventional approach has been tightening the acceptance limits, in order to assure quality. The accuracy of measurements systems, process variation, failure costs and adjusting acceptance limits are vital parameters for optimizing costs in electronics manufacturing. Constant product performance requirements have lead to ever tighter specifications in modern high technology sector. The improvement in design of manufacturing processes has been even faster Product variation is a significant factor affecting product quality and causing costs. Therefore, it is sensible to minimize product variation in manufacturing. There are numerous methods of minimizing variation (prevention), e.g. statistical process control (SPC) tools six sigma methods, Taguchi´s Design of experiments. Also, the development and purchase of different test methods and equipment are economically feasible (appraisal). Test equipment investments require, however, economic justification.

### 4.1 Maintaining the process within specification

In oil seed processing industry different it is necessary and mandatory to maintain the raw material and process parameters within company specification. Without maintaining these process parameters (temperature; pressure, etc.) it is impossible to produce products with good quality. For example during oil seed processing using single screw extruders, we have to test the raw material moisture content with in specification at (9 – 13%). If we process the oil seeds that have high moisture contents, the water will mixed with crude oil and it take time to evaporate the water and refine the crude oil to obtain pure refined oil. Each machine or equipments have its own operation condition and parameters. For example in oil pressing using SPU-20 extruder the operating temperature will be $85^0$c. If this temperature vary, the operation will be out-of- specification. So; to obtain quality product, the process parameter must be setted within operating specifications.

| Self-Check 4 | Written Test |
|---|---|

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

1 Explain how to maintain the process within specification (6pts )

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

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

## Information Sheet 5 - Monitoring the extrusions process

### 5.1 Introduction

The major operations involved in the production of oil are cleaning of the raw material, conditioning, pressing, filtering and storage. At the first step oil seeds are properly cleaned by de-hulling. After cleaning operation the seeds are taken to the expeller (or Press) as needed. The expeller breaks up to seed and subject it to pressure, thereby removing oil which is expelled from the machine and can be stored in drums. Oil extraction can be done mechanically with an oil press, expeller, or even with a wooden mortar and pestle-a traditional method that originated in India. Almost all the oilseeds yield oil more readily if cooked adequately prior to their mechanical expression and/or solvent extraction. The cooking process coagulates the proteins present in the seed causing coalescence of oil droplets and making the seed permeable to the flow of oil. The process also decreases the affinity of oil for the solid surfaces of seed because of which the best possible yields of oil are obtained on expression/extraction of cooked seed.

### 5.2 Monitoring the extrusions process

The cooking temperatures and its duration periods for durations of working for most oilseeds range between and 30 -120 minutes respectively. Optimum conditions for cooking of an oilseed depend on several factors such as; initial moisture content, and bio-chemical characteristics, cooking methods, equipment used, and method of oil extraction. Certain amount of moisture is essential in oilseeds (between 9-14.5%) to achieve the desirable heat effects on their cooking. Very dry oil seed cannot be efficiently heat treated without addition of some moisture. On the other hand, the oilseeds containing over 15% moisture require adequate drying during as well as after cooking to achieve efficient crushing. Optimal levels of moisture in most of the cooked oil seeds for hydraulic and expeller pressing is reported to be respectively 5 - 6 and 2-3%.

The two types of Extrusions process in oil seeds processing are:

- Batch or
- Continuous

✓ **In batch processes**

- The crude oil is drained off, distilled and extracted until the residual oil content in the batch of flakes is reduced to the desired level.

✓ **In continuous extraction**

- The oilseeds are fed into the extractor continuously and the oil was extracted continuously until the recommended amount of oil remain in the cake.

The common oil extrusion processing from oil seeds are shown in figure below:

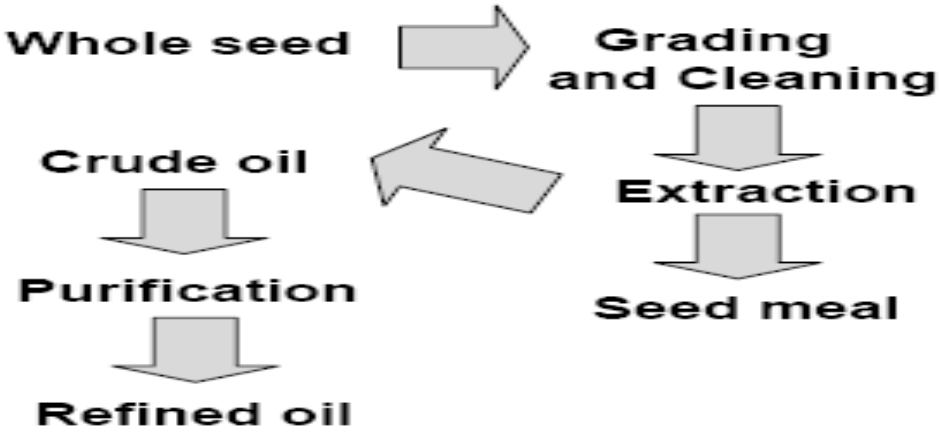


**Figure 14. Oil extrusion process**

**Notice: extrusion oil processing** video

https://www.youtube.com/watch?v=kzYtVIO_k4I&pbjreload=101

https://www.youtube.com/watch?v=eFE3PrLMxDE

**Figure 15.Screw oil pressing machine**

### 5.3 Quality Parameters on extrusion process

From the foregoing it can be stated that a food extruder may be considered as a reactor in which temperature, mixing mechanism and residence time distribution are mainly responsible for a certain physical state, as is the viscosity. Quality parameters such as the texture are often dependent on the viscosity. The influence of various extruder variables like screw speed, die geometry, screw geometry and barrel temperature on the produced quality has been described by numerous authors for many products. However, other extrusion-cooking process variables like initial moisture content, the intentional presence of enzymes, the pH during extrusion, and so on, also play a role. Although a variety of test methods is available a versatile instrument to measure the changes in consistency during pasting and cooking of biopolymers is hardly available. A number of measuring methods are used in the extrusion-cooking branch. A compilation of them is from which it can be seen that an extrusion-cooked product is described in practice b its bulk density, its water sorption, its wet strength, its dry strength, its cooking loss and its viscosity behavior after extrusion for which the Brabender viscometer producing amylographs may be chosen, which gives information about the response of the extruded material to a controlled temperature time function.

## 5.4 Challenges in extrusions process

As the awareness of food quality and the concern about food safety has increased, it has forced the food and feed industries to place more emphasis on the consistency of product quality. Food process control has therefore become of considerable importance in recent years. In extrusion cooking, biopolymers, mainly starches and proteins, are plasticised with water and subjected to mechanical and thermal energy treatment to achieve the desired texturization for food type end products and specific functional properties for modified starches and/or proteins. Control of extrusion processes is difficult due to strong interactions between mass, energy and momentum transfer, coupled with complex physico-chemical transformations, which govern final product properties. The primary extrusion process parameters include feed formulation, feed moisture content, feed rate, screw speed, barrel temperature and screw and die configuration. For most extruder applications, typically die pressure, die temperature, and motor torque (or current) are used as measured process outputs to monitor product quality indirectly.

| 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 two oil seed processing methods ?(10pts )

2 Write the quality parameters on extrusion process (6pts)

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

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

## Information Sheet 6 - Maintaining the work area with the housekeeping standards

### 6.1 Introduction

Maintaining the work area cleanness is playing the vital role of the organizational success. It includes keeping work areas neat and orderly; maintaining halls and floors free of slip and trip hazards; and removing of waste materials (e.g., paper, cardboard) and other fire hazards from work areas.

It also requires paying attention to important details such as the layout of the whole workplace, aisle marking, the adequacy of storage facilities, and maintenance. Good housekeeping is also a basic part of accident and fire prevention

A safe work environment Including facilities, Amenities and accommodation.

Facilities refer to toilets, washrooms, showers, lockers, dining areas, drinking water, etc. These facilities must be in good working order, clean, safe and accessible. When considering how to provide and maintain facilities that are adequate and accessible, a person conducting a business or undertaking must consider all relevant matters including

- The nature of the work being carried out at the workplace
- The nature of the hazards at the workplace
- The size, location and nature of the workplace
- The number and composition of the workers at the workplace.

### 6.2 Maintaining the work area with the housekeeping standards

During Conducting work in accordance with workplace guideline a person should ensure the following requirements.

#### 6.2.1 Legislative Requirements

A person conducting a business or undertaking at a workplace must ensure so far as is reasonably practicable, the following:

- The layout of the workplace allows, and the workplace is maintained so as to allow, for persons to enter and exit and to move about without risk to health and safety, both under normal working conditions and in an emergency,
- Work areas have space for work to be carried out without risk to health and safety,
- Floors and other surfaces are designed, installed and maintained to allow work to be carried out without risk to health and safety,
- Ventilation enables workers to carry out work without risk to health and safety,
- Workers carrying out work in extremes of heat or cold are able to carry out work without risk to health and safety,

### 6.2.2 Responsibilities

- Facilities Management Division (or Equivalent)
  - ✓ Are designed and installed according to company legislative and requirements
  - ✓ Are inspected and maintained to ensure a safe level of hygiene.
- Company Management and Supervisors

Management and supervisors of faculties, divisions and units are to ensure that amenities and facilities in the workplace do not expose workers, or visitors to health and safety risks.

This includes:

- Employees

Employees are responsible for reporting any identified hazard in the work environment, facilities or amenities that they become aware of in accordance with factory or company guidelines.

### 6.2.3 Needs Assessment

The work environment, facilities and amenities are provided for basic health and welfare of employees. These include items such as:

- Toilets
- Rest rooms
- Shelter sheds
- Dining rooms
- Drinking water
- Accommodation

- Waste receptacles
- First aid facilities/rooms (refer to first aid guidelines).

### 6.2.4 Work Environment

Work environment includes/consider: work layout, work access, floors and other surfaces, work station, lighting, air quality, and heat and cold.

- **Work Layout**

The layout of the workplace is required to allow persons to enter and exit the workplace and move within safely, both under normal work conditions and in an emergency.

- **Entry and Exit**

Entries and exits are required to be safe to allow impeded access and egress for all workers, students and visitors including those with special needs.

- **Housekeeping**

Untidy workplaces may lead to injuries e.g. slips and trips, therefore good housekeeping practices are essential for all workplaces.

For example:

- ✓ Spills on floors should be cleaned up immediately
- ✓ Walkways should be kept clear of obstructions
- ✓ Work materials should be neatly stored
- ✓ Any waste should be regularly removed
- ✓ Suitable containers for waste should be conveniently located and regularly emptied.

- **Work Areas**

The layout of the work area should be designed to provide sufficient clear space between machines, fixtures and fittings so workers can move freely without strain or injury also evacuate quickly in case of an emergency.

- **Floors and Other Surfaces**

Floor surfaces shall be suitable for the work area and be chosen based on the type of work being carried out at the workplace, as well as the materials used during the work process, the likelihood of spills and other contaminants, including dust, chemicals, and the need for cleaning.

- **Workstations**

Workstations should be designed so workers are comfortable undertaking their task and allow for a combination of sit and standing tasks.

For tasks undertaken in a seated position, workers should be provided with seating that:

- ✓ Provides good body support, especially for the lower back
- ✓ Provides foot support, preferable with both feet flat on the floor, otherwise a footrest shall be provided
- ✓ Allows adequate space for leg clearance and freedom of movement
- ✓ Is fully adjustable to accommodate different size workers (e.g. seat height, back rest height and back rest tilt adjustments) and should not tip or slip utilizing a five-point-base
- ✓ Chairs shall be fitted with castors for carpeted surfaces and glides or braked castors on hard surfaces.

- **Lighting**

Sufficient lighting is required to allow safe movement around the workplace and to allow workers to perform their job without having to adopt awkward postures or strain their eyes to see. Emergency lighting is to be provided for the safe evacuation of people in the event of an emergency. The following factors are to be taken into account:

- ✓ The nature of the work activity
- ✓ The nature of hazards and risks in the workplace
- ✓ The work environment
- ✓ Illumination levels, including both natural and artificial light
- ✓ The transition of natural light over the day
- ✓ Glare Workplace Environment Guidelines
- ✓ Contrast
- ✓ Reflections.

- **Air Quality**

Workplace are to be adequately ventilated which includes provision of fresh, clean air drawn from outside the workplace, uncontaminated from flues or other outlets and be circulated through the workplace.

Workplace inside buildings may have natural ventilation, mechanical ventilation or air conditioning.

An air-conditioning system should:

- ✓ Provide a comfortable environment in relation to air temperature, humidity and air movement
- ✓ Prevent the excessive accumulation of odors.
- ✓ Reduce the levels of respiratory by-products, especially carbon dioxide, and other indoor contaminants that may arise from work activities
- ✓ Supply an amount of fresh air to the workplace, exhaust some of the stale air as well as filter and recirculate some of the indoor air.

- **Heat and Cold**

Refer to the Thermal Comfort Guidelines for further information on managing health and safety risks associated to hot and cold environments.

### 6.2.5 Welfare Facilities

- **Access**

Workers, including those who have particular needs or disabilities, must have access to the facilities provided.

Workers are to be provided with:

- ✓ Adequate breaks to use the facilities
- ✓ Facilities which are within a reasonable distance from the work area
- ✓ Shift workers have similar access to those who work during the day
- ✓ A means of access which is safe.

- **Personal Storage**

Accessible and secure storage should be provided at the workplace for personal items belonging to workers.

This storage should be separate from that provided for personal protective equipment in cases where contamination is possible.

- **Change Rooms**

Persons required to change clothes before and after work should be able to access a change room.

This includes workers who need to:

- ✓ Wear personal protective clothing or uniforms while they are working
- ✓ Leave their work clothing at the workplace.

- **Shower Facilities**

Where dirty, hot or hazardous work is undertaken showering facilities should be provided. Showers should have:

- ✓ Floor area of not less than 1.8m2
- ✓ A Slip resistant surface that is capable of being sanitized
- ✓ A Partitions between each shower that are at least 1650mm high and no more 300cm above the floor
- ✓ An adjacent dressing area for each shower containing a seat and hooks
- ✓ A Lockable door enclosing the shower and dressing cubicle

- **Shelter Facilities**

Where persons are required to be performing tasks offsite and can be exposed to environment elements appropriate shelter is to be provided.

### 6.2.6 Inspection and Monitoring

The work environment, facilities and amenities need to be periodically inspected to ensure they conform to relevant legislation, standards and codes of practice and are maintained and serviced appropriately. Any non-conformances identified throughout the inspection require a risk control assigned to an appropriate person.

Review of the work environment, facilities and amenities are required when:

- Work practices, equipment or workplaces are modified
- Employees numbers increase

- New work processes are introduced
- An incident impacting on the health, safety or welfare of employees occurs.

Where it is identified that the workplace environment, facilities or amenities pose a health and safety risk, the issue should be reported to the supervisor and recorded.

Corrective actions may include a review of the area in relation to the information contained in guideline, WHS Regulation, Code of Practice or other information.

| Self-Check 6 | Written Test |
|---|---|

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

1. What are the requirements a person should ensure during conducting work in accordance with workplace guideline(6pts )
2. Write at list five items that a work environment, facilities and amenities are provided for basic health and welfare of employees. (5pts )

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

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

## Information Sheet 7 - Recording Workplace information requirements

### 7.1 Introduction

Recording workplace information in processing industry is very important activities that must be performed which helps to produce consistent products. Workplace information include:

- Standard Operating Procedures (SOPs)
- Specifications
- Production schedules and instructions
- Manufacturers' advice
- Standard forms and reports

### 7.2 Standard Operating Procedures (SOP)

SOP is a process document that describes in detail the way that an operator should perform a given operation. SOPs involve the purpose of the operation, the equipment and materials required, how to perform the set-up and operations required for the process, how to perform the maintenance and shut down operations carried out by the worker, a description of safety issues, trouble-shooting,a list of spare parts and where to find them, illustrations, and checklists. In addition, SOPs are frequently used as checklists by inspectors when auditing procedures. Ultimately, the benefits of a valid SOP are reduced work effort, along with improved comparability, credibility, and legal defensibility.

### 7.3 Specification

A specification is exact statement of the particular need to be satisfied, or essential characteristics that customer requires (in a good, material, methods, process, service, or work).

## 7.4 Production schedules and instructions

In production scheduling the products to be manufactured and their quantities are determined initially. The sequence of manufacturing processes required for the production of these items are also established. The manufacturing resources are then allocated to perform production processes to realize various items. This is spread over a predetermined time. This function is known as production scheduling. The objectives of scheduling also include maximization of the resource utilization, minimization of the work-in-process inventory, reduction of manufacturing lead time, etc.

| 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 workplace information that must be recorded in an oil processing industry?(6pts )
2. Define specification (5pts )
3. Write the objectives of production scheduling(5pts )

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

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

| Operation Sheet #1- | Operation procedure for Oil seed extrusion |
|---|---|

Operation procedures or techniques of oil seed extrusion

1. Wear personal protective equipment (PPE)
2. Adjust extruder temperature and screw speed
3. Weigh raw materials
4. Clean raw materials
5. Sort and grade raw materials
6. Fed or load raw material in to oil extruder
7. Extract crude oil
8. Collect the extracted crude oil using collection tank or vessels.
9. Collect by products(cake)
10. Shutdown process
11. Clean extruder
12. Record data

| LAP TEST #1 | Performance Test |
|---|---|

Name……. ID……. Date ……..

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 2 hour. The project is expected from each student to do it. During your work: You can ask all the necessary tools and equipment.

**Task- 1: Operate oil extrusion Process**

| LG #40 | LO #3 - Shut down the Extrusion process |
|---|---|

**Instruction sheet**

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

- Identifying shutting down procedure
- Shutting down process
- Identifying and reporting maintenance requirements

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

- Identifying shutting down procedure
- Shutting down process
- Identifying and reporting maintenance requirements

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks

## Information Sheet 1- Identifying shutting down procedure

### 1.1 Identifying shutting down procedure

Shutdown procedure which will be done after extracting oils may include but not limited to:

- Workplace procedures in the process of shutting.
- Equipment is dismantled and prepared for cleaning.

### 1.2 Seven steps/procedures for a successful shutdown

Follow these steps to ensure a successful outage and restart. Scheduled outages may be plant wide, occur through different sections or be cold or running. Job plans for each asset is a prerequisite.

**Step 1: A comprehensive list**

A checklist with every piece of equipment involved in the outage should be available for review. Every stakeholder should examine this list to ensure nothing is missing. Examples of assets for most plant checklists include: Agitators, Airlocks, Conveyors, Doors, Dust baggers, Gearboxes Man ways Mixers and blenders, Motors, Piping, Pumps, and Valves.

**Step 2: Have it in inventory**

Ensure that all replacement parts, accessories and rebuilt equipment are in stock before the shutdown. The last thing any team needs is to have staff on hand to conduct maintenance, replacements and new installations only to be held up waiting for rebuilt equipment to return from a shop.

**Step 3: Safety first**

Safety should be the top priority during any outage. Before beginning work, all lock out/tag out (LOTO) procedures should be followed and personnel must wear all required personal protective equipment (PPE).

Because equipment is shut down, personnel may have a false sense of security

**Step 4: Within current specifications**

Double check that all equipment (new and rebuilt) is within current operating parameter specifications. When assets were specified, they met the requirements of the process at that time. Condition changes, such as fluid temperature, flow requirement or process fluid pH must be considered. Different parts or different equipment may need to be used.

**Step 5: Inspect before installation**

Personnel should inspect all equipment before anything is installed; look for wear or damage. Installing new components into a worn piece of equipment is almost always counterproductive. Demise of the new components begins immediately.

**Step 6: Precise installation**

While this step seems obvious, improper installation happens all the time. Reliability begins with the asset selection and correct installation. If installed imprecisely, failure begins at startup

**Step 7: Inspection before restart**

The plant team should give everything one more look before restarting the plant or process. Even when every step is taken and every job plan is followed, stuff happens. A motor is bumped during work on another piece of equipment, causing misalignment. Housekeeping staff accidentally hits a piece of equipment. A wrench left on an asset may have fallen.

| Self-Check -1 | Written Test |
|---|---|

Name… ..... ID…..... Date…….....

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

**Test –I. Short answer questions**

1. Write the seven steps/procedures for a successful shutdown
   (10 points)

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

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

## Information Sheet 2- Shutting down process

### 2.1 Shutting down process

Shut down is a term used to describe the process of closing all systems of process control systems. Normal shutdown includes steps to render the systems safe, such as removal of hazardous process materials and inert (asphyxiating) gases. The systems might be cleaned as part of the shutdown; cleaning is often a machine shutdown is a temporary closure of a building to perform maintenance. The main activities should be preventative in nature with the focus on equipment inspections. This is the best time to replace worn-out or broken process materials and equipment at their useful end-of-life process unto itself requiring its own set of startup, operation, and shutdown procedures.

### 2.2 Shut down the process includes

Shutdown procedure may include but not limited to:

- The appropriate shutdown procedure is identified.
- The process is shut down according to shutdown procedures.
- Maintenance requirements are identified and reported according to workplace reporting requirements

During extrude operation, after extracting the oil and separating the by-product (cake or meal) you have to shut down the extraction process. This process are;

- First switch off power
- Un-plug power socket
- Clean external parts of extruder
- Clean internal parts like, screw or barrel
- If maintenance are needed, list out damaged parts in maintenance check list and report to maintenance operators or supervisors.

## 2.3 Uses of Shutdown Processes

- Safely shut down of the equipment.
- To locate emergency stop functions on the equipment.

| Self-Check -2 | Written Test |
|---|---|

Name… ..... ID…..... Date…….....

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

**Test –I. Short answer questions**

1. Define shutdown process mean (4 points)
2. Shut down the process includes (6points)

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

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

## Information Sheet 3 - Identifying and reporting maintenance requirements

### 3.1 Introduction

Maintenance is a general upkeep and repair of equipment, buildings and grounds, heating and air-conditioning; removing toxic wastes; parking; and perhaps security

Food premises and equipment that are not kept in good repair and condition are a potential source of microbiological and physical contamination of food. Poorly maintained premises and equipment cannot be cleaned effectively. Poor maintenance may allow the entry of other sources of physical, microbiological and chemical contaminants such as water, pests and dust. Poor maintenance can have health and safety implications for workers.

### 3.2 Identifying and reporting maintenance requirements

To minimize the hazards that might be happen during equipment operation, you have to check that the equipment was in a god operating condition or not. If there is a defects on it, report and undertake maintenance before starting operate equipment.

The maintenance that needed may be adjusting thermocouple, pressure sensors, some components of a machine or equipment and etc.

### 3.3 Maintenance activities

Maintenance of equipment was the basic and mandatory activities in an industry. Many hazards that might be happen was due to lack of maintenance activities before, during and after operating a machine or an equipment. The following are the maintenance activities that will be done in a food processing industries. Such as:

- Operational maintenance (e.g. connection-disconnection of hoses, greasing, lubrication and lubricant systems, adjusting sealing glands, cleaning and changing filters, 'nipping up' flanges)
- General cleaning

- Removal and replacement (e.g. gland packing, changing blades or cutters, replacing gaskets, replacing /maintaining seals, changing filter elements, servicing strainers).

### 3.4 Routine maintenance

Routine maintenance tasks refer to on-going, scheduled tasks that are performed in order to keep hand tools and basic equipment functioning properly. It could include tasks such as unblocking pipes and nozzles, sharpening blunt tools, cleaning nozzles on sprayers, checking water and oil levels in machinery, cables and plugs.

#### 3.4.1 Some tips on routine maintenance, we have to follows

- Use the correct tool for the job
- Keep tools in good condition
- Handles should be tight and free from defect
- Cutting tools should be kept sharp
- Use and maintain power tools according to their operator instructions
- Make sure power tools are properly grounded or are double insulated
- Switch off and unplug power tools before changing blades or servicing and repairing
- Wear appropriate personal protective equipment (PPE), such as glasses, goggles, dust masks, face shields, hearing protection, etc.
- Keep all guards and shields in place
- Unplug and store tools after use

During Routine maintenance tasks on extruder we perform the following tasks.

- Tighten nuts and bolts.
- Tighten shafts.
- Oil exposed steel e.g. spades, shovels and forks.
- Unblock pipes and nozzles.
- Clean nozzles on sprayers.
- Check water and oil levels in machinery.
- Check and maintain cables and plugs.

### 3.4.2 Scheduling routine maintenance

Some tools may require daily checks and maintenance after use. Other tools, such as power tools, usually must be checked once in 6 months or so. More complicated power tools would need to be serviced on a regular interval

A maintenance schedule assigns a specific date to specific maintenance tasks.

It states what has to be checked and will require that the assigned person signs off the document assuring that the checks were done.

If faults are found, the tool must be sent for maintenance and the assigned person that fixes the tool has to report on exactly what was done and when it was completed.

- An example of a checklist used for maintenance request was given below:

**Table 3. Routine maintenance checklist**

| Date | Tool | Maintenance check points | Signature | Maintenance required | Signature |
|---|---|---|---|---|---|
| 14-10 /2020 | Extruder | Die | Mr. A | Die | |
| | | Shaft | Mr. A | Shaft | Mr. B |
| | | Screw | Mr. A | None | |

- Maintenance performed were reported using a checklist below.

**Table 4. Maintenance report checklist**

| Maintenance Performed | Date | Signature |
|---|---|---|
| The dies was replaced | 16-10/2020 | Mr. C |
| The shaft was replaced | | |

| Self-Check - 3 | Written Test |
|---|---|

Name… ..... ID…..… Date…….....

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

**Test –I. Short answer questions**

1. Define maintenance (4 points)
2. Write the routine maintenance tasks on extruder (6points)
3. Define Routine maintenance (4 points)

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

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

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- Product variation is a significant factor affecting product quality and causing costs. Therefore, it is sensible to minimize product variation in manufacturing. There are numerous methods of minimizing variation (prevention), e.g. statistical process control (SPC) tools six sigma methods.

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