CONFECTIONARY PROCESSING

Level-II

Based on *May* 2019, Version 2 Occupational standards

Module Title: Operating a high and low boiled Confectionery Process

LG Code: IND COP2 M20 (LO1-3) (LG 66-68)

TTLM Code: IND COP2 TTLM 0920v1

October 2020

United Nations
Educational, Scientific and
Cultural Organization

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LG #66	LO 1: Prepare the high/low boil equipment and process for operation

Instruction sheet

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

- Confirming and operating availability of service
- Selecting and combining the product ingredients and reprocessed product/rework for syrup
- Identifying and confirming the cleaning and maintenance requirements status
- Entering and processing/operating parameters
- Checking and adjusting equipment
- Caring out pre-start checks as required by workplace 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:

- Confirm and operating availability of service
- Select and combining the product ingredients and reprocessed product/rework for syrup
- Identify and confirming the cleaning and maintenance requirements status
- Enter and processing/operating parameters
- Check and adjusting equipment
- Cary out pre-start checks as required by workplace requirements

Learning Instructions:

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”.

Information sheet 1	Confirming and operating availability of service

1.1 Confirming and operating availability of service

Candy making is the preparation and cookery of candies and sugar confections. Candy making includes the preparation of many various candies, such as hard candies, jelly beans, gumdrops, taffy, liquorice, cotton candy, chocolates and chocolate truffles, dragées, fudge, caramel candy and toffee.

Candy is made by dissolving sugar in water or milk to form a syrup, which is boiled until it reaches the desired concentration or starts to caramelize. The type of candy depends on the ingredients and how long the mixture is boiled. Candy comes in a wide variety of textures, from soft and chewy to hard and brittle.

A hard candy, or boiled sweet, is a sugar candy prepared from one or more sugar-based syrups that is boiled to a temperature of 160 °C (320 °F) to make candy. Among the many hard candy varieties are stick candy such as the candy cane, lollipops.

Most hard candy is nearly 100% sugar by weight, with a tiny amount of other ingredients for color or flavor, and negligible water content in the final product. Recipes for hard candy may use syrups of sucrose, glucose, fructose or other sugars. Sugar-free versions have also been created.

Once the syrup blend reaches the target temperature, the candy maker removes it from the heat source and may add citric acid, food dye, and some flavouring, such as a plant extract, essential oil, or flavoring. The syrup concoction, which is now very thick, can be poured into a mold or tray to cool, or a cooling table in case of industrial mass production. When the syrup is cool enough to handle, it can be folded, rolled, or molded into the shapes desired. After the boiled syrup cools, it is called hard candy, since it becomes stiff and brittle as it approaches room temperature.

1.1.1 Boiling Points

Colligative properties are defined as those properties that depend on the number of particles present rather than the nature of the particles. In sugar confectionery, the most important of these is the elevation of the boiling point. Because sugars are very soluble, very large boiling point elevations are produced, e.g., as large as 50 °C. Remembering that the elevation of the boiling point is proportional to the concentration of the solute, it is not surprising that the boiling point is used as a measure of the concentration and hence as a process control.

The boiling point of a liquid is the temperature at which the vapor pressure is equal to the atmospheric pressure. If the pressure is increased, the boiling point will increase, whereas reducing the pressure will reduce the boiling point. Most sugar confectionery is made by boiling a mixture of sugars to concentrate them. The use of a vacuum has several advantages. The energy consumption is reduced, browning is reduced, and the process is speeded up.

A common practice is to boil a mixture of sugars under atmospheric pressure to a given boiling point. A vacuum is then applied. This causes the mixture to boil under reduced pressure. This not only concentrates the mixture while the latent heat of evaporation cools it rapidly but also speeds up the production process, since the product will ultimately have to be cooled to ambient temperature.

1.1.2 Services

Water is present in sufficient quantity in cake batters to dissolve sugar , salt and other solid ingredients. Water adds moisture to the finished cakes and also regulates the consistency of the batter. It develops the protein in the flour to a very limited extent in order to retain better the gas produced by baking powder in the cake formula**.**

- **Lighting and power**

Where lighting is needed, florescent tubes use less electricity than bulbs, but care is needed when using fluorescent lights above mixer/blender and other equipment that has moving or rotating parts. This is because they can make machinery appear stationary at certain speeds, causing a hazard to operators.

Electricity is preferred for bakery ovens because it is clean, flexible and easily controlled. Electric motors should be fitted with isolators and starters. Plugs should be fitted with fuses that suit the power rating of the equipment and the main supply should have an earth-leakage trip switch. All electric wiring should be of the correct type for the intended purpose and installed by a qualified and competent electrician.

Where a three-phase (440 volt) supply is used in larger mixer, the load should be equally spread over the three phases.

- **Water supply and sanitation**

Water is used in bakeries to make dough and for washing equipment. An adequate supply of potable (safe for drinking) water should be available from taps in the processing room. There are two potential problems with the water quality: sand and contaminating microorganisms.

Self-check 1	Written test

Name…… ID…… Date…….

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

I Say true or false the following questions (1.5 each)

1. The boiling point of a liquid is the temperature at which the vapor pressure is equal to the atmospheric pressure.
2. Candy is made by dissolving sugar in water or milk by forming a syrup.
3. Water is used in bakeries to make candy and for washing equipment.
4. Electricity is preferred for bakery ovens because it is clean, flexible and easily controlled.

II choose the best answer from the given alternatives. (2point each)

1. The basic raw material for the process of candy is:
   A. Water B. syrup C. sugar D. all
2. candy is grouped under:
   A. Beverage B. confectionary C. fruit D. all

Answer Sheet

Score = _____

Rating: _____

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

Name: _____ Date: _____

Information sheet 2	Selecting and combining the product ingredients and reprocessed product/rework for syrup

2.1 Selecting and combining the product ingredients and reprocessed product/rework for syrup

- **Preparation of syrup**

The high heat dissolves the sugar, evaporates the water and breaks apart the sugar's molecules, causing the sugar syrup to get hotter and denser, resulting in sugar syrup with concentrated sugar molecules. At The residue (rework) syrups were produced in a continuously stirred tank, dissolving the candy residue in water .After dissolution, the pH of the mixture was corrected to 6.0, with the addition of sodium bicarbonate. The syrup was then let to rest for 30 min. The scum and salt precipitates formed during this process were removed before further processing. Depending on the candy being made, the syrup is boiled to a codified temperature, measured with a Candy Thermometer

Most candy recipes require that the sides of the pot be washed down early in the cooking process, either with a wet pastry brush or by putting the lid on the pan for a few minutes to remove any sugar crystals clinging to the container walls. Afterwards, clamp or place a candy thermometer on the side of the pan.

Fig 2.1 boiling candy syrup

Keep the temperature constant; never this point, the sugar molecules are tightly concentrated in the water, reaching a super saturation state, while at the same

time more unstable. Even without heat, crystallized sugar will dissolve in water. Up to a certain point.

The general principle with candy making is that at a particular temperature, a given solvent (in this case, water) can dissolve only so much of a particular solute (sugar), reaching its saturation point where no more sugar can be dissolved. In other words, sugar crystals added to the solution after saturation will just sink to the bottom of the container. But heating the sugar/water solution will increase the amount of sugar that can be dissolved. That's because heat disrupts sugar's crystalline structure, breaking apart the sugar's molecules which allow more of it to dissolve in the water. As you have probably already found out, sugar dissolves more readily in hot liquids than in cold.

2.1.1 Lollipop:

Ball, double-ball and flat lollipops in one, two, three or four colors, with a multi-component capability providing solid, centre-filled, layered and striped options for the production.

Procedure for making lollipop:

1. Sugar melting tank: heating sugar, glucose, water to 110 degrees.
2. Storage tank: storage the sugar syrup and filting pure syrup.
3. Micro-film cooker: cooker the syrup again to 145 degrees for better taste, moisture is lower then 2%, suits for international standard.
4. Depositing and Cooling: depositing the sugar syrup into different candy moud
5. Stick Plug machine: plug the stick into the lollipop moulds
6. Packing machine: various packing machine

https://youtu.be/0qHq3QX-eiU

Fig 2.2 Lollipop

Candy preparation steps:

STEP 1: prepare the sugar solution the sugar solution is made from crystalline (table) sugar (sucrose), sometimes along with its close relative such as glucose or corn syrup (invert sugars), dissolved in water.

STEP 2: cook (boil) the sugar solution into a concentrated sugar syrup it is then, **cooked (boiled)** into a concentrated sugar syrup to a codified density and temperature.

Steps 3: cooling

Step 4 beating (optional) It is allowed to cool and any kneading, beating and manipulation may follow.

Fig 2.3 hard candy

https://youtu.be/dFCj0CflfQU

Fig 2.4 Corn syrup

2.1.2 Fondant

Fondant and fudge confectionery in a variety of colours,flavours,fillings and shapes. They can be chocolate coated and include centre fillings like nuts, jelly or fruit pieces.

Fig 2.5 fondant

https://youtu.be/arFFR45LqCg

What is fondant made of:

Store bought fondant can be made of many things but in general, it's made from sugar, flavorings and some sort of gum (to make it stretchy). Depending on the exact combination, your fondant texture can range from soft and sticky to chewy or even tough.

Marshmallow fondant doesn't have that many ingredients. Marshmallows provide the main structure. Marshmallows contain mostly sugar and gelatin. A little bit of vegetable shortening helps the fondant from drying out

How to make fondant:

1. Marshmallows in 30-second bursts until fully melted
2. Add your water and pour melted marshmallows into the bowl of a stand mixer with the dough hook attached
3. Add in your vegetable shortening
4. Start adding in all your powdered sugar one cup at a time, leave one cup out
5. Let your fondant mix on low until smooth, this can take 5 minutes or so
6. Scrape the fondant out of the bowl with a spatula into your bowl of remaining powdered sugar
7. Knead the mixture until all the powdered sugar is incorporated

8. Heat up your store bought fondant for 30 seconds and add it to the marshmallow fondant
9. Knead until fondant can be stretched like taffy without breaking

2.1.3 Nougat

Nougats are often made in the frappé process, where a marshmallow-like foam stabilized by a protein source is folded into cooked sugar syrup followed by careful addition of fat so as not to break the foam. The sugar syrup is cooked to the desired temperature to reach the end moisture content of the confection prior to blending with the frappé. In grained nougat, the final addition is powdered sugar to help set the grain. To form, the candy is most often slabbed (e.g., as a layer on a cold table) and allowed to cool before being cut into the desired shapes. Stickiness is a key problem with nougats since T_g is low enough to cause the sugar syrup to fall into the sticky zone, especially when the candy is warm.

❖ **Nougat processing steps:**

- The whipping agent is prepared and beaten
- The cooked syrup is added to the whipping agent;
- The mixture is aerated; flavors and other ingredients are blended into the mixture
- The mixture is cooled; and the product is formed.
- Each of these **process steps** will be addressed, with an emphasis on aeration https://youtu.be/e_nxTxRniZw

High-quality toffee and caramel products can be made in an assortment of colors, and can include added-value centre fillings such as nuts, jam and chocolate.

Caramel and toffee are one of the most basic and yet versatile candy products and constitutes a large part of the confectionery industry. Both are versatile and widely used confectionery products after chocolate. They produce images of delicious, chewy taste in the minds of consumers

Word Toffee was used to denote those products that do not contain milk solids and prepared by using brown sugar, glucose syrup and fat mainly butter fat. They appear in many aspects quite similar to butterscotch but differ in the intensity of heating. Unlike butterscotch they contain slightly higher moisture content. Processing of milk led to the inclusion of milk solids in toffee formulation and resultant product contains slightly higher moisture in the range of 8-9 percent.

The demarcation line between caramel and toffee is very thin. Differentiation between the two can be done on the basis of moisture content which is slightly higher in caramel as compared to toffee. Term Caramel is also used to describe products made by the breakdown of carbohydrate by heat or heat and alkali treatment. These are mainly used as coloring matter.

Caramel may be found in a range of textures, colors, flavors and products. This common confection may be consumed alone as or in combination with chocolate, nougat, marshmallows, nuts and other inclusions. Some applications include caramels wrapped for consumption, for depositing into chocolate shells, as ice cream toppings and ingredient in other confections or desserts. Likewise Toffee is also available in various textures ranging from soft to hard brittle, which is mainly governed by the composition and final cooking temperature.

Fudge is another type of confectionary product which resemble to caramel or toffee but differs in the processing as in it sugar crystals are developed during the cooking. Normally it contains more sugar and milk as compared to toffee or caramel. The mixture of sugar, milk and butter or vegetable fat is heated to soft-ball stage (116 ^{0}C) and then beating the mixture when it cools so that it can acquire a soft, creamy consistency. The characteristics of fudge are more dependent on processing conditions rather than formulation. The three important criteria for good quality fudge are:

Must be microbiologically safe

Must be firm

Should have uniform texture

❖ **Properties of Caramel and Toffee**

They may be described as **soft glasses** that are viscous in nature and contain a dispersion of milk protein and an emulsion of fat in highly concentrated sugar solution. Caramel is manufactured by heating mixture of sugar, corn syrup, fat and milk solids (protein) at 110-130^{o}C, followed by cooling and moulding of cooked mass. Soft caramel which is used as a layer in confectionery bars is prepared by heating to the lower temperature range and has a moisture content of about 10%. The resulting product is a viscoelastic liquid consisting of fat droplets in a matrix of sugars and protein. Toffee or caramels can be deliberately made to crystallize or grain and are then called as grained caramels or soft toffees. These products are quite similar to fudge but are made by adopting altogether different process.

The texture of caramel must be controlled in order to achieve the desired flow patterns and machinability in the production lines, to maintain product specifications and to ensure a long shelf life.

Fig 2.6 toffee and caramel

Self-check 2	Written test

Name…… ID…… Date…….

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

I Say true or false the following questions (1.5 each)

1. The high heat dissolves the sugar during syrup preparation.
2. Hard candies are a high boiling process confectionary.
3. Lollipop, nougat and caramel are low boiling process confectionaries.
4. Syrup is the basic raw material for confectionaries.

II choose the best answer from the given alternatives (2point each)

1. From the following one is under confectionary.

   A. caramel B. nougat C. candy D .all

2. The PH of syrup mixture during candy processing is:

A. 6 B.7 C.4 D. 2.5

Answer Sheet

Score = _____

Rating: _____

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

Name: _____ Date: _____

Information sheet 3	Identifying and confirming the cleaning and maintenance requirements status

3.1 Identifying and confirming the cleaning and maintenance requirements status

Cleaning removes and separates off-specification material, organic and non-organic debris, metals, and pesticide residues, among other contaminants, from the raw material prior to further processing.

Reasons for Cleaning, includes the following:

- 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, e.g. Tesco
- 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

Fig3. 1 Cleaning Equipment's

❖ The main purpose of cleaning is to remove undesirable foreign material and it should be designed to obtain:

1. Complete removal of separated contaminants and avoidance of recontamination
2. Maximum separation efficiency consistent with minimum wastage of desirable material
3. Minimum quantity and concentrations of residues the foreign material found on fruits and vegetables can be grouped under the following heading

3.1.1 Cleaning Methods

A) Dry cleaning

Dry cleaning methods are used for products that are smaller, have greater mechanical strength and possess lower moisture content. The main advantages of dry cleaning methods are that, these methods are generally inexpensive and involve cheaper equipment than wet cleaning methods and produce a concentrated dry effluent which may be disposed of more cheaply but it suffers from various disadvantages such as, it is prone to production of dust, which can be a source of product recontamination and in some cases, a fire and explosion hazard.

The main groups of equipment used for dry cleaning are:

- Aspirators
- magnetic separator
- Separators based on screening of foods

B) Wet Cleaning

Wet cleaning more effective than dry cleaning for removing soil from root crops or dust and pesticide residues from soft fruits or vegetables. It is also dustless and causes less damage to foods than dry methods. Different combinations of detergents and sterilizers at different temperatures allow flexibility in operation. Use of warm cleaning water may

accelerate chemical and microbiological spoilage unless careful monitoring is done over washing times and subsequent delays before processing.

The correct sequence of a general cleaning procedure for surfaces in a food plant is:

- Gross Clean/Preparation
- Pre-rinse
- Detergent application
- Post-rinsing
- Disinfection
- Terminal rinsing

Fig 3.2 Cleaning Equipment's

❖ **Gross Clean/Preparation**

This step is most often omitted by food companies. This prevents effective cleaning of plant surfaces due to food residues remaining.

Negative impacts include:

- Protection of surfaces and bacteria from the action of detergents
- Reaction with and consumption of the detergent
- Holding bacteria and resulting in recontamination of the surface

A poor gross clean is the single biggest reason for poor or inconsistent bacterial counts on surfaces and for high bacterial contamination in aerosols caused by rinsing. A well designed cleaning procedure will provide for the removal of all food pieces greater than a fingernail before applying detergent. Ideally this should be done dry by hand, scrapping or other physical method. The collected material should be placed in waste receptacles and removed from the area. All ingredients, food and packaging materials should also be removed from the area prior to gross cleaning.

- **Pre-rinsing**

The purpose of this step is to remove deposits which cannot be easily removed by picking, scrapping or other manual form of gross cleaning. Excess water should be removed following pre-rinsing to avoid dilution of the detergent in the following step.

Fig 3.3 Pre-Rinsing

- **Detergent Application**

The purpose of the **detergent** is to remove the layers of proteins, greases and other food deposits that remain on surfaces. Detergents are not designed to remove large

pieces of food deposits or thick layers of fat. It is in these layers that bacteria can survive and grow and make the use of a disinfectant pointless.

Foam should be conducted carefully and methodically and there should be a check to ensure that all surfaces have been covered. Detergents should be made up and used according to the suppliers instructions and appropriate time should be allowed for the detergent to work.

- **Post Rinsing**

The purpose of post rinsing is to remove the remaining food deposits. Care should be taken to minimize the amount of splash and aerosol formed which may re-contaminate surfaces. After post rinsing the surface should be free of all visible deposits, layers of soiling and residues of detergent. Any residues of detergent may neutralize the action of any subsequent disinfectant. Any pools or accumulations of water should be removed following post rinse.

- **Disinfection**

Disinfection should only be carried out on a visually clean, well rinsed surface, with minimal amounts of water. Direct food contact surfaces should be disinfected at least daily with other surfaces disinfected on a regular basis. Disinfectants should be used safely according to the supplier's instructions.

- **Terminal Rinsing**

Most disinfectants are safe to leave on non-food contact surfaces without final rinsing. In some sections of the food industry there is a requirement to rinse food contact surfaces with water after disinfection. The standard of the water is important to ensure that the disinfected surface is not re-contaminated.

3.1.2 Confirming Maintenance

- **Equipment Maintenance**

Equipment maintenance another reason for lost production is delays caused by waiting for spare parts after equipment breaks down. As a minimum, cereal processors should monitor the state of equipment that is likely to wear out and as their experience grows over the years, they should buy spare parts or send the machine for servicing when

they expect that a component is due to be replaced. There are likely to be a few parts that wear out more quickly than others (e.g. mixer bearings, heating elements in bag sealers, drive belts and hammers in mills). These should be identified and spare parts kept in stock.

To put preventive maintenance into practice, the following actions are needed:

- Identify priority machinery which have components that wear out more frequently
- Make a clear description of the procedures and standards for the work of machine operators and maintenance workers (such as lubricating, tightening bolts, adjustments etc.) In daily, weekly and monthly routine maintenance plans
- Organize a schedule and train staff to implement maintenance plans.
- Prepare a maintenance budget
- Record inspection results, analyses the records and evaluate the success of maintenance
- Continuously update procedures and standards. Cleaning tools are an essential 'must have' to implement an effective cleaning programme, but the choice available is vast and often confusing and conflicting with many variations and designs to choose from.

Efficiency and effectiveness in their ability to clean equipment and reduce contamination are the essential requirements for purchasing cleaning tools.

They need to offer the protection against threats and dangers you can see and, more importantly, for those you cannot – 24hours a day.

Cleaning equipment is often used over large surface areas and can collect and spread contamination. Data has shown that 47% of the cleaning equipment used can be positive for Listeria monocytogenes which demonstrates that cleaning equipment can be a major collection point for pathogens.

Incorrect storage, failure to replace old or faulty cleaning tools, and incorrect design of cleaning equipment are all key factors contributing to potential microbiological hazards.

Cleaning should reduce the risk of bacteria, not contribute to the loading on equipment and the environment.

Using clean equipment that is fit for purpose and effective sanitizing of equipment between use is one line of defense to prevent bacterial contamination. But a second line of defense that is increasing in popularity and reduces the threat of cross-contamination is the use of antimicrobial cleaning tools within the food production environment. These can provide round-the-clock antimicrobial product protection.

A growing range of cleaning tools that make cleaning and hygiene both effective and more efficient are coming on to the market.

Self-check 3	Written test

Name…… ID…… Date…….

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

I. Say true or false the following questions (1.5 each)

- Cleaning equipment is often used over large surface areas and can collect and spread contamination
- The purpose of the detergent is to remove the layers of proteins, greases and other food deposits that remain on surfaces
- Dry cleaning methods are used for products that are smaller, have greater mechanical strength and possess lower moisture content
- Cleaning removes and separates off-specification material, organic and non-organic debris, metals, and pesticide residues,

II. Choose best answers for the following questions

1. Reasons for Cleaning, including

A. To meet specific customer requirements
B. To meet the requirements of global food safety standards (GFSI)
C. To maintain positive audit and inspection outcomes
D. all

2. The main groups of equipment used for dry cleaning are:

A. Aspirators
B. magnetic separator
C. Separators based on screening of foods

Answer Sheet

Score = _____

Rating: _____

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

Name: _____ Date: _____

Information sheet 4	Entering and processing/operating parameters

.1 Entering and processing/operating parameters

During operating parameters the operator has to control the parameters like temperature, pressure viscosity ,Moisture

- **Moisture**

Analysis of variance indicated that the extrusion moisture content was significant to product temperature, die pressure, and percent torque while the cooking temperature was only significant to the product temperature ($p < 0.001$, data not shown). Response surfaces of product temperature die pressure and product temperature as functions of extrusion moisture content and cooking temperature. As the moisture content increased from 60 to 70% (wb), the percent torque, die pressure and product temperature significantly decreased. This was because water serves as a lubricant in the extruder.

- **Pressure**

There are a number of different pressure transducers. The most common ones in extrusion are the strain gage transducer and the piezo-electric transducer. The strain gage transducer can be either a capillary or a pushrod transducer. In these transducers there are two diaphragms, one in contact with the plastic melt and one some distance away from the hot plastic melt.

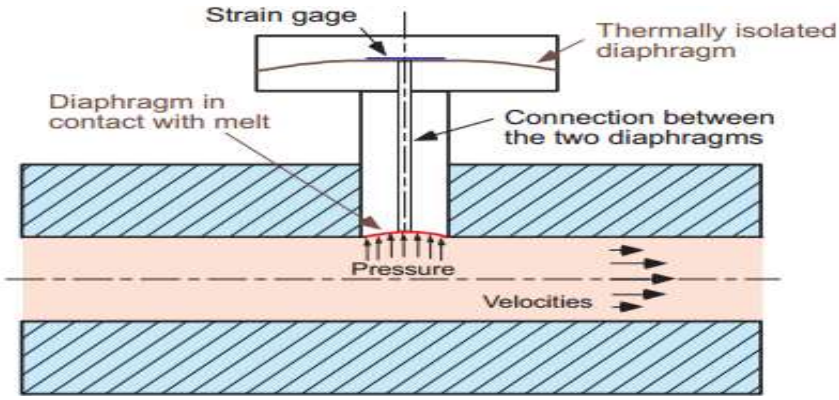

Fig 1 Pressure

- **Temperature**

Increasing cooking temperature from 138 to 160^{0}C significantly increased product temperatures. Die pressure and percent torque, on the other hand, revealed little changes. This was contrary to the general expectation that a higher product temperature would have a lower viscosity resulting in a lower percent torque and die pressure.

- **viscosity**

This was probably because of the increased protein denaturation and texturization as the product temperature was increased. While increasing product temperature reduced the viscosity, this was more or less counteracted by the simultaneous increase in protein denaturation and texturization, which increased viscosity.

Common additives used in confectionary includes:

- **Sugars:** granulated sugar, dark brown sugar, and confectioners' sugar.
- **Sweeteners**: corn syrup and honey.
- **Dairy products:** unsalted butter, heavy cream, whipping cream, and whole milk.
- **Nuts:** pecan halves, whole and sliced almonds, English walnuts, raw and roasted Spanish peanuts, cashews, and macadamias.

The independent variables were solute concentration, process temperature and process duration. The responses evaluated for deciding the optimum conditions were water loss, solute gain, color difference, water activity, ascorbic acid, hardness and overall acceptability. The derived optimum conditions were used for the development of sand pear candy to check the validity of the quadratic model.

There are complicated correlations between process parameters and quality indicators in candy manufacturing. The objective of this work is to develop an optimization system of candy production process to improve final candy quality and to increase production efficiency. The study is conducted by using an artificial neural network data mining

method to obtain optimization knowledge of process parameters from large amount of saved process data.

Self-check 4	Written test

Name…… ID…… Date…….

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

I Say true or false the following questions (1.5 each)

1. Sugars: granulated sugar, dark brown sugar, and confectioners' sugar are ingredients of candy process.
2. There are complicated correlations between process parameters and quality indicators in candy manufacturing.
3. The independent variables were solute concentration, process temperature and process duration.
4. Temperature, pressure and flow rate are the factors that affect process of confectionary.

II choose the best answer from the given alternative.

1 During entering parameters the controlled parameters are: **(4point)**

A. Temperature B .pressure C. flow rate D. all

Answer Sheet

Score = _____

Rating: _____

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

Name: _____ Date: _____

Information sheet 5	Checking and adjusting equipment

5.1. Checking and adjusting equipment

A variety of tools and machines are used in making candy, ranging from simple kitchen tools like bowls and spoons to elaborate factory machinery.

After the equipment is installed according to the requirements of the manual, the entire unit should be calibrated, including the center position calibration of the extrusion blow machine head and the clamping device.

- **Checking the safety of devices:**

Before starting the machine, the safety of devices should be checked according to the following procedure:

  - Correct operation of the emergency stop button while the machine is working, press the emergency button the machine should stop immediately.
  - Correct operation of the safety limit switches.
  - machine is working lift the protection should stop immediately

- **Adjusting equipment of the process**
  Is the process of setting the processing parameters or the equipment after the equipment fit for the process.

5.2 Condition Monitoring using Operating Equipment Performance Monitoring

Measuring machinery health by performance monitoring has the potential to give warning of a developing failure through the changing levels of a suitable parameter being measured, thereby indicating a change in condition of a component, machine or system.

Keyword

- Machinery performance monitoring.
- Machine condition assessment.
- Equipment health monitoring.

❖ **Condition Monitoring and Process Analysis**

This is essential in identifying impending failure and will be applied to critical areas identified in the reliability plan. The current state-of-health of process plant is important information related to current information, diagnosis and prognosis of various defects, and predicted useful life in the optimization of safety, quality and high production rates.

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

Condition Monitoring has historically focused on the acquisition and analysis of measurable parameters that would give useful information as to the condition of machine components and, hence, a forecast of the likely serviceability of the machine.

The wider view of Condition Management must take into account

- the performance of the machine
- or the system of which it is a part
- And report on excursions away from previously defined acceptable tolerances.

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

5.1.1. The Purpose of Performance Monitoring

There is the classic story of the condition monitoring technician who completed a vibration survey on a pump after it was reported as running erratically. He reported that the pump had the lowest vibration levels ever measured and it was therefore in perfect condition. Shortly after receiving this advice the plant operator noted that the pressure gauge was much lower than usual and further investigation showed that the pump wasn't pumping at all!

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The technology of Process Control allows access to much of the information needed to trend machinery and system performance parameters. These parameters are monitored and alarms set for out-of-tolerance conditions. This is particularly true for systems more so than individual machines unless they are process critical and individual monitoring can be justified.

With continuing advances in sensor technologies and a growing trend for on board mounted machinery sensors permitting on-line monitoring, the performance mentoring of machines and the systems in which they work will give people real-time information on equipment health and condition and let them fine-tune the process to maximize uptime and machine reliability.

Fig 5 .1 hard candy production line

Self-check 5	Written test

Name…… ID…… Date…….

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

I Say true or false the following questions (1.5 each)

1. A variety of tools and machines are used in making candy, ranging from simple kitchen tools like bowls and spoons to elaborate factory machinery
2. Condition Monitoring has historically focused on the acquisition and analysis of measurable parameters that would give useful information as to the condition of machine components.
3. Monitoring also: the process of systematic data collection and evaluation to identify changes in the performance.
4. Adjusting is the process of checking whether equipment is set or not.

II Explain the following question

1. What is the use of equipment adjusting or setting? (4point)

Answer Sheet

Score = _____

Rating: _____

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

Name: _____ Date: _____

Information sheet - 6	Caring out pre-start checks as required by workplace requirements

6.1 Carrying out a pre-start checks

Preliminary operations: check if the confectionary machine has been damaged during transport. Check the condition of the machine taking a close look at the outside and the inside. Any deformation of the visible parts indicates that the machine has been hit by something during transport. This could lead to malfunctioning. Check the tightening of screws, bolts and fittings.

Damage caused by transport should be attributed to the carrier and the manufacturer or its agent should be informed immediately of the situation.

During pre-start check the operator should:

a. Check the Cleaning of the machine

- Remove the dust and dirt deposited on the surface during transport.
- Carefully clean and dry each part (varnished or unvarnished) using soft, clean and dry cloths
- Should the box pallets remain outdoors for some time, waiting to transported inside the building, these box pallets should be covered with adequately-sized waterproof tarpaulins.
- If storage exceeds 3 months the box pallets should be stored inside, sheltered from bad weather and protected from excessively high or low temperatures.
- If the machine is unpacked, it should be covered in order to prevent the buildup of dust and dirt.

b. Checking the safety devices:

Before starting the machine, the safety devices should be checked according to the following procedure:

- Correct operation of the emergency stop button, while the machine is working, press the emergency button: the machine should stop immediately.
- Correct operation of the safety limit switches, while the machine is working lift the protection grid, the machine should stop immediately.

All operator manuals will have a list of pre-start or daily checks. Some companies will also have a checklist that you must complete every time you use the machine.

Table 1 shows prestart check list format.

Pre-shift Checklist

Vehicle registration: DR21 TYP	Week no: **15**						
Item to be checked	Sat	Sun	Mon	Tues	Wed	Thurs	Fri
1 Clock hours	1543		1550	1613			
2 Fluid levels (engine, hydraulics, transmission, battery)	✓		✓	✓			
3 Coolant level	✓		Topped up	✓			
4 Wheels (wheel studs, tyre condition)	✓		✓	Damage to rear offside tyre			
5 Light/horn/wipers/indicators/mirrors	✓		✓				
6 All glass: lights/lenses/mirrors/ trailer lights	✓		✓				
7 Check hydraulics for leaks	✓		✓				
8 Brakes/handbrake	✓		✓				
9 Guards all fitted (inc PTO)	✓		Cracked PTO cover				
10 Defect reporting form reference number if applicable			2034				
Comments							
Initials	JKL		AH				

All defects that cannot be rectified immediately must be recorded on a defect reporting form.
Do not drive a vehicle if you have any concerns about its safety.

Track down the checklist, stopping to complete each check.

Track across to the right day to complete the box.

For example, you are now on Check 4 for Tuesday.

There isn't much room here. Keep **writing** clear and simple.

Put details in the defect reporting form.

Make sure you are familiar with any **technical words** or **abbreviations** on the checklist.

If you need to find information in the checklist, use **scanning** skills to find it.

You will be trained to carry out these checks. Use the operator manual for more information.

Self-check 6	Written test

Name…… ID…… Date…….

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

I Say true or false the following questions (1.5 each)

1 All operator manuals will have a list of pre-start or daily checks

2 It is important to carry out a series of checks after using a piece of machinery.

3 If the machine is unpacked, it should be covered in order to prevent the buildup of dust and dirt.

4 Before starting the machine, the safety devices should be checked according to the work place procedure.

II Explain the following question.

1. What is the importance of pre-start check(4point)

Answer Sheet

Score = _____

Rating: _____

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

Name: _____ Date: _____

Operation sheet 1	Making lollipop

Procedure for:

Step 1 Sugar melting tank: heating sugar, glocose, water to 110 degrees.

step 2 Storage tank: storage the sugar syrup and filting pure syrup.

step 3 cook the syrup by using Micro-film cooker again to 145 degrees for better taste, moisture is lower then 2%, suits for international standard.

Step 4 Depositing and Cooling: depositing the sugar syrup into different candy moulds.

step 5 plug the stick into the lollipop moulds

step 6 Pack lollipop

Operation sheet 2	Candy making

Procedure:

Step 1 Mix sugar and corn syrup with enough water.

Step 2 Heat to dissolve granulated sugar.

Step 3 Add other ingredients for specific confections – Milk, fats, hydrocolloids, colors, flavors, acids, etc. – May be added either before or after cooking.

Step 4 Boil to remove excess water

Step 5 Cool the process

Step 6 Form aeration

Step 7 Pack the product.

Operation sheet 3	Making fondant

Procedure:

Step 1Marshmallows in 30-second bursts until fully melted

Step 2 Add your water and pour melted marshmallows into the bowl of a stand mixer with the dough hook attached

Step 3 Add in your vegetable shortening

Step 4 Start adding in all your powdered sugar one cup at a time, leave one cup out

Step 5 Let your fondant mix on low until smooth, this can take 5 minutes or so

Step 6 Scrape the fondant out of the bowl with a spatula into your bowl of remaining powdered sugar

Step 7 Knead the mixture until all the powdered sugar is incorporated

Step 8 Heat up your store bought fondant for 30 seconds and add it to the marshmallow fondant

Step 9 Knead until fondant can be stretched like taffy without breaking

Operation sheet 4	Nougat making

Procedure:

Step 1 prepare the whipping agent and beaten

Step 2 add the cooked syrup to the whipping agent;

Step 3 aerate mixture , flavors and other ingredients are blended into the mixture

Step 4 cool the mixture.

Step 5 each of these **process steps** will be addressed, with an emphasis on aeration

LAP TEST	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 for each. The project is expected from each student to do it.

Task 1: making lollipop

Task 2: Candy making

Task 3: Making fondant

Task 4: Nougat making

LG #67	LO #2 Operate and monitor the high/low boil process

Instruction sheet

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

- Delivering ingredients, additives and reprocessed product
- Starting and operating the process
- Monitoring and identifying the equipment
- Identifying and reporting the variation of equipment in maintenance
- Heating, cooking and cooling the product
- Identifying and rectifying the out of specification
- Maintaining the work area

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:

- Deliver ingredients, additives and reprocessed product
- Start and operating the process
- Monitor and identifying the equipment
- Identify and reporting the variation of equipment in maintenance
- Heat, cook and cool the product
- Identify and rectify the out of specification
- Maintain the work area

Learning Instructions:

6. Read the specific objectives of this Learning Guide.
7. Follow the instructions described below.
8. Read the information written in the information Sheets
9. Accomplish the Self-checks
10. Perform Operation Sheets
11. Do the “LAP test”

Information Sheet -1 Delivering ingredients, additives and reprocessed product

All sugar-based candies, whether creamy, chewy, brittle, aerated or soft, are essentially mixtures of two ingredients: sugar and water. Some chemical names of additives, such as sodium chloride (salt) and sodium bicarbonate (baking soda), have become familiar to many consumers. But many chemical names remain unfamiliar to consumers.

Sugar boiled confectionery is a processed composite food article made from sugar with or without doctoring ingredients such as cream of tartar by process of boiling whether panned or not. It may be center filling or otherwise which may be in the form of liquid, semisolid or solids with or without coating of sugar or chocolate or both.

Delivering high/low boiling ingredient is a confection made mainly out of pulverized sugar, or icing sugar with binding materials such as edible gums, edible gelatine, liquid glucose or dextrin and generally made from cold mixing which does not require primary boiling or cooking of the ingredients.

c. High boil ingredients

- **Sugars:** granulated sugar, dark brown sugar, and confectioners' sugar.
- **Sweeteners**: corn syrup and honey.
- **Dairy products:** unsalted butter, heavy cream, whipping cream, half and half, and whole milk.
- **Nuts:** pecan halves, whole and sliced almonds, English walnuts, raw and roasted Spanish peanuts, cashews, and macadamias

The following is a list of common high boil and low boil additives for making candy:

- **Albumin:** any of several proteins that are coagulated by heat and found in egg white, milk, and soy products. The proteins are used to bind ingredients in candies such as mint patties.
- **Citric acid:** the predominant acid in citrus fruits (oranges, lemons, limes), it gives candies such as lemondrops their tart flavor.
- **Dextrose:** a corn sweetener made from dehydrated cornstarch. Also known as corn sugar, it is the dry form of glucose.
- **Gelatin**: a protein that functions as a gelling agent in gummy candies. It is obtained from collagen derived from beef bones and calf or pork skin.
- **Malic acid**: the predominant acid in apples, it adds tartness to candies for flavoring.
- **Malt dextrin:** generally derived from cornstarch, it is used as a bodying or bulking agent, texturizer, carrier, and sugar-crystallization inhibitor.
- **Modified food starch:** derived from cornstarch, tapioca, or potato, this ingredient is used as a thickener, binder, and stabilizer in candy.
- **Pectin:** a gum obtained from citrus peel and apple pomace. It is used to make gelled candies, such as gumdrops.
- **Potassium sorbate:** a preservative that is the potassium salt of sorbic acid, also a preservative.
- **Sodium aluminum phosphate**: a leavening agent that slowly releases carbon dioxide during candy processing, adding volume and texture to hard candies or baked fillings, such as cookies and peanut-butter cups.
- **Sorbitol:** a sugar that is 60 percent as sweet as sugar and 50 percent as caloric. It is a polyol (sugar alcohol) that maintains moistness in candy and provides taste and body in sugarless candy and chewing gum.

d. Low boiling ingredients

- **Glycerol monostearate**: an emulsifier used in candies such as licorice.
- **Gum Arabic or gum acacia:** a gum used to stabilize emulsions in candy coatings. It is derived from the Anogeissus latifolia tree, where it acts as a protective sealant when the bark is damaged.
- **Gum base**: one of the primary ingredients for candy production.

Note: Low boil additives are same to the hard boil additives

Figure 1 additives

Figure 2 Ingredients

1.2. General guidelines for handling and reprocessing products

The finished product or other reusable items require appropriate handling and reprocessing to:

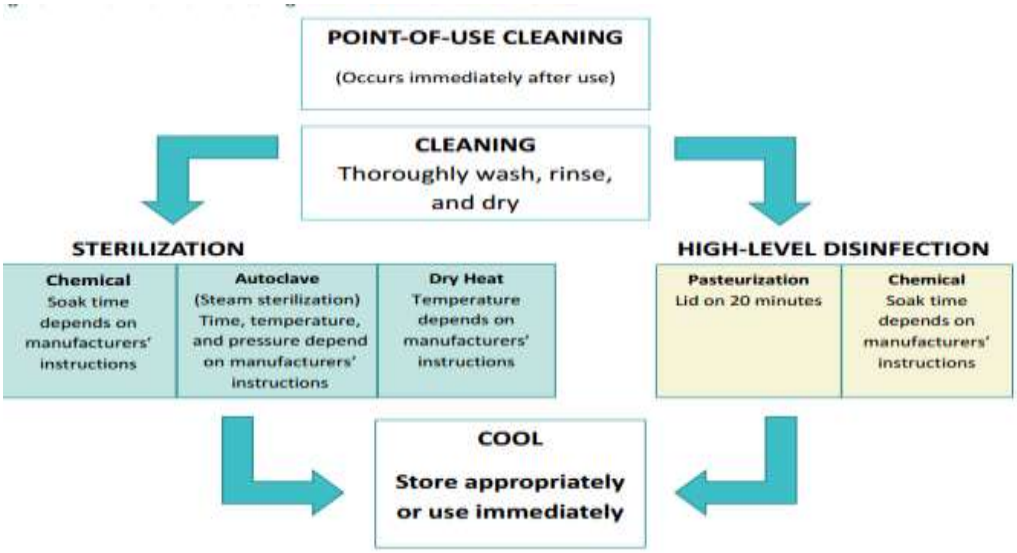
- Minimize exposure to cross contamination or poison for the housekeeping, transportation, and reprocessing staff
- Ensure that they are not vectors of health care-associated infections

Staff must wear appropriate PPE when handling reprocessing product to protect themselves from exposure to safety and health

This PPE includes:

- Gloves: utility gloves, which should have high cuffs when there is a chance hands will be submerged in cleaning solutions
- Gown: fluid and dust-resistant gown
- Face protection: mask and integrated visor, full visor, or mask with goggles
- Footwear: with closed toes, and non-skid soles such as rubber boots or leather shoes. Shoe covers can be worn to protect shoes.

Table 1 Major workflow steps in Reprocessing



Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test I: say "True" or "False" for the following questions (2 point)

1. Malt dextrin is a sugar that is 60 percent as sweet as sugar and 50 percent as caloric.
2. Staff must wear appropriate PPE when handling reprocessing product.
3. All sugar-based candies, whether creamy, chewy, brittle, aerated or soft, are essentially mixtures of two ingredients sugar and water.

Test- II match column "A" with column "B". (2pts.)

A	B
1. Gelatin	A. reprocessing product
2. coagulated by heat	B. Albumin
3. PPE	C. Candy additives
4. To minimize cross contamination	D. Gown & foot shoes

Answer Sheet

Score = _____

Rating: _____

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

Name: _____ Date: _____

Information Sheet 2-	Starting and operating the process

2.1. Starting and operating the process

To start heat the boiler slowly will be explained throughout this procedure and it can take many hours for a large cold boiler to be heated correctly to operating temperature and pressure. Timing will also depend on how much treated water is available to fill the boiler, so be prepared for a long day and you may have to include a shift handover procedure to safely complete the task.

The boiling of a refrigerant is a complicated process. It changes with induced pressure drop, the type or blend of refrigerants, the temperature difference between the hot and cold sides and other factors. Sugar confectionery, as the name suggests, is rich in sugar; any sugar or type of sugar. There are two types of sugar confections: boiled sweets and fondant.

Boiled sweets are “Sugar and water boiled at such a high temperature (150–166 °C) that practically no water remains and a vitreous mass is formed on cooling” whereas fondant has been defined as “Minute sugar crystals in a saturated sugar syrup; used as the creamy filling in chocolates and biscuits and for decorating cakes. This is prepared by boiling sugar solution with the addition of glucose syrup or an inverting agent and cooling rapidly while stirring.

The most important factors influencing the high/low boiling process:

A. Temperature profile inside the evaporator

The boiling temperature of a refrigerant at a certain pressure is called the saturation temperature. At the saturation temperature, any additional energy absorbed by the refrigerant will transform liquid to gas. If the pressure is constant, the temperature will remain at the saturation temperature until no liquid remains. Only at the point where no liquid refrigerant is present can the temperature of the vapor increase, i.e. become

superheated.

B. Effect of pressure drop

- Attention to start the boiler:
  1. Under no circumstances should the boiler be left unattended until all of the Following steps have been completed and the boiler is up to pressure and Temperature and back on-line if appropriate.
  2. Also take care when handling chemicals or working on live steam etc.; always That PPE appropriate to the task is worn.
  3. Also remember that most accidents in boiler houses are falling from height.

Fig 1 2 Checking and starting the boiler process

Working at height can include pits and trenches as a “working at height hazard”. The following points have been carefully put together to help you bring a cold steam boiler back into service and back on-line

safely.

Before starting operation boiler process the workers:

- Have Short term training
- Become familiar with the safe operation of the equipment, operator must know the machine working principle and operation
- should train. The owner of the machine is responsible for training the users.
- Check bolts and other loosen parts and tighten it before operation will start.
- Should maintain, inspect, attach and detach parts, park the machine at flat and safe place.
- Use proper tools to maintain the machine and check working area is safe. During Operating
- Only allow responsible person, who are familiar with the instructions, to operate

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: Say true/false

1. The boiling temperature of a refrigerant at a certain pressure is called the saturation temperature. (4point)
2. At the saturation temperature, any additional energy absorbed by the refrigerant will transform liquid to gas. (4point)

Test II: Give short answer.

1. Write the attention to start the boiler (4point)

_____

_____

Note: Satisfactory rating ≥ 4 points Unsatisfactory - below 4 points

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

Information Sheet- 3 Monitoring and identifying the equipment

3.1. Monitoring and identifying the equipment

Monitoring is the systematic process of observing project or program activities, collecting, analyzing and using information to track a programmer's progress toward reaching its objectives and to guide management decisions.

Workers have to monitor the equipment's operation correctly and report tools/equipment malfunctions or problems according to procedures to his immediate supervisors. A monitoring and control system for monitoring the boil equipment of the contents of a boiling utensil located on a boiling surface of a boiling top, indicating the state to a user, and controlling the energy applied to the boiling surface, which may be a glass ceramic.

The signal issued by the sensor is representative of the temperature of either the boil top, or the boiling utensil. In one embodiment the signal processing device detects a plateau in the sensor and power indicative signals, which is indicative of the boiling of the contents of the boiling utensil, or an increase in the rise of the sensor signal, which is indicative of a boil condition in the boiling utensil.

The following are used Checking those boiling equipment's during identifying and monitoring their performance:

- Candy Making Equipment & Utensils
- Heavy-gauged saucepan (at least 4 quart)
- Baking pans or marble slab for cooling candy
- Cookie sheets (lined with waxed paper)
- Heavy duty spatula for kneading cooked candy
- Pastry brush to wash down sides of pan

- Wooden spoons to stir candy while cooking
- Dipping forks
- Thermometer - Select one that has two-degree markings and can clip to the cooking pan. Always test before using.
- pan or cooking/boiling pot
- pump
- buffer thank
- panel board

Figure 1 monitoring machine boiling point

Self-check 3	Written test

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

Name…… ID…… Date…….

Test I: Give short Answer (5pts.)

1. Write at list five boiling equipment's to be identifying and monitoring.
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____

Test II: Fill in blank space (3pts.)

1. _____ is the systematic process of observing project or program activities, collecting, analyzing and using information to track a programmer's progress.

Answer Sheet

Score = _____

Rating: _____

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

Name: _____ Date: _____

Information Sheet- 4	Identifying and reporting the variation of equipment in Maintenance

4.1. Identifying and reporting the variation of equipment in maintenance

Workers have to identify the high/low boiler equipment's operation correctly and report tools/equipment malfunctions or problems according to procedures to his immediate supervisors.

Equipment Variation

It measures one appraiser has when measuring the same part using the same gage more than one time. This variation is usually referred to as equipment variation (EV) in the gage.

Sources of variation in measurements

a) Subject Variation

Difference made on the same subject occasions may be due to several factors, including:

- Physiological changes
- Factors affecting response
- Changes because of awareness

b) Observation Variation

Variations in recording observations arise from several reasons including: Bias, errors, and lack of skills or training.

Operating parameters like temperatures and pressures.so all these expected deviations has to be recognized monitored and reported

4.2. Reporting for equipment maintenance

Report to your immediate supervisor any tool or piece of equipment that is broken or does not function properly or unsafe equipment to a responsible individual to prevent serious injury.

Maintenance report details of each event in the time range, including the:

- Setup/Takedown
- Time, Instructions,
- Event Time, Facility, Event, ID (Rental, Contract or Event),
- Service, and Customer.

- **Fig 2 Reporting Maintenance requirements**

Self-check 4	Written test

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

Name…… ID…… Date…….

Test I: Give short answer (5pts)

1. at list write 5 the of Variables of equipment

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

Test II: Fill in the blank space. (3pts.)

1. _____ have to identify the high/low boiler equipment's operation correctly and report tools/equipment malfunctions or problems according to procedures to his immediate supervisors.

Answer Sheet

Score = _____

Rating: _____

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

Name: _____ Date: _____

Information Sheet- 5 Heat cooking and cooling the product

5.1. Heat cooking and cooling the product

Heat cooking is the greater numbers of candies are prepared by means of the action of moist heat on sugar. They are simply solutions of sugar and water with various forms of flavoring added, boiled until this solution reaches a definite concentration or consistency.

This consistency may be determined in various ways:

- The length of time of cooking,
- The way in which the syrup drops from the spoon,
- The consistency of the mass it forms when cool in cold water

These tests as generally used are most inaccurate. Providing we start with the same proportions of sugar and water, the concentration of our solution must depend upon the amount of evaporation. This is not dependent solely upon the length of time of cooking, but is influenced by such factors as the amount of surface exposed and the intensity of the heat applied; therefore the first test above is most inaccurate.

The tests depending upon the way the syrup drops from the spoon and the consistency of the mass when cooled in water, while more accurate than the above, still vary considerably in the hands of different experimenters, and in the latter case especially are der pendent upon the temperature of the water

5.1.1 Effect of moist heat on sugar

This brings us to a consideration of our second topic or the effect of moist heat on sugar. We find that moist heat splits up cane sugar, forming from it two simpler sugars,

glucose and fructose. The relation between these three sugars is that cane sugar with the aid of heat and water splits up into fructose and glucose.

5.2. Cooling the product

Active cooling should start within 90 minutes of the end of cooking. The aim is for food to be cooled to 5˚C as quickly as possible. With the exception of the cooling of small volume confectionery products, it may be difficult to achieve this target quickly enough unless a blast chiller is used. Whatever method is used, it is important that food passes through the temperature danger zone (from 63˚C to 5˚C) as quickly as possible.

The cooling of cookies is of critical importance and must be carried out safely. Most types of food poisoning bacteria multiply fastest when food is within the “Danger Zone” (from 63˚C to 5˚C) it is vital that food is cooled as quickly as possible. There are different methods of cooling and the overall time taken to cool depends on the food’s nature, density and size as well as the type of equipment used. Remember to protect food during cooling.

The following are Methods of cooling the product:-

- **Blast Chilling:** It is strongly recommended that a blast chiller is used, although this may not be feasible for some businesses. This is an effective method of cooling hot food quickly and reducing the risk of bacterial growth during the cooling process. Remember to always follow the manufacturer’s instructions.
- **Cooling small items such as pies:** Cool for no longer than 90 minutes at ambient temperature, then place into chilled storage.
- **Cooling of candy:** Protect the cooked product within a sealed bag and immerse in a container of cold or iced water of drinking quality.
- **Cooling puddings** Cool by placing directly into a container of cold or iced water of drinking quality.

e. Procedures of heating the boiler

When you need to bring a sugar mixture to a specific heat stage, it is always the most accurate to use a candy thermometer but if you do not own one you can still check the sugar mixture by using the cold water method.

- When making candy, place a 1- or 2-quart saucepan over medium-high heat until the pan is warm, not hot.
- Add the sugar and cook, stirring occasionally with a wooden spoon, until all of it has melted.
- Clamp on a Candy Thermometer.
- The sugar syrup will take on a light golden brown at 320 degrees F or whatever the recipe indicates.
- Quickly remove the pan from the heat and shock it in ice-water bath by immersing pan half way for 5 seconds.
- Remove the caramel to either a greased marble slab, silpat mat or a heat-proof bowl.
- Proceed with the recipe.

f. Modern Method – Heating Microwave Method

The microwave method uses it as a heat source and is a quick and fail-safe method.

- Place 1/2 cup sugar in a 2-cup Pyrex glass measuring cup.
- Add 1/4 cup corn syrup or 4 to 5 drops of lemon juice. Stir until all combined.
- Add 1 tablespoon water, if necessary.
- Place in a microwave and microwave on high until bubbles start piling up on top of one another. Watch mixture very carefully.
- As soon as you see a color change, watch carefully, as the mixture will quickly go from light to dark in color.

g. Procedures of cooling the product.

1. Use personal protective equipment/PPE
2. Check the product cooling equipment/ machine
3. Check cooling temperature and time
4. Monitor the product
5. Operate the cooling process

Self-check 5	Written test

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

Name…… ID…… Date…….

Test I: Say "true" or "false" for the following questions (3pts.)

1. Heat cooking is the greater numbers of candies are prepared by means of the action of moist heat on sugar.
2. Active cooling should start within 1hours of the end of cooking.

Test II: Short Answer Questions (4pts.)

1. Write at list four Methods of cooling the product
   a. _____
   b. _____
   c. _____
   d. _____

Answer Sheet

Score = _____

Rating: _____

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

Name: _____ Date: _____

Information Sheet 6- Identifying and rectifying the out of specification

6.1. Identifying and rectifying the out of specification

The term out of specifications, are defined as those results of in process or finished product testing, which falling out of specified limits. The out of specifications (OOS), may arise due to deviations in product manufacturing process, errors in testing procedure, or due to malfunctioning of analytical equipment. When an out of specifications (OOS) has arrived, a root cause analysis has to be performed to investigate the cause for OOS.

Three method of out-of-specification process outcomes identification

A. Reality Check

- You've noticed what looks like a problem – take a deep breath.
- Is this a real problem? How do you know?
- Can you describe it? Do you know enough about the problem to describe it in a meaningful way?
- Is it urgent? Is it important to resolve this problem right now?
- Do you have any prior knowledge or experience with this or similar problems?
- Who should you talk to? Is there someone else who can help you?
- Make up your mind – do you pursue this or not?

B. Problem Identification (assuming you're going to pursue it)

- Think back about what you, the process, the team, the organization or whatever were doing just prior to the problem.
- Look at the symptoms of the problem without disturbing the condition of the system, process or whatever is giving off problem signals.
- Consider the possibility of specification error, that is, you're misinterpreting what you're seeing.

- Ask yourself if there are alternative explanations for what's occurring (or did occur in the past).
- State your description of the problem.

C. Investigation

- Think about how the problem can be reproduced – this is useful to test a) your understanding of it and b) check effectiveness of any proposed solutions.
- Identify the symptoms of the problem – symptoms are signs of how things appear and are not necessarily causes.
- Try to understand how severe could the problem be – you may not see the full, worst case manifestation of it so you need to avoid coming up with a over-simplified or weak solution.
- Now drill down into what might be causing the problem – look for the cause and
- Consider alternative solutions, for example, what might be a workaround? No need to create complicated solutions if you can run around the obstacle in some other easier and more efficient way.
- State your recommended solution and why you think it will work.
- Talk to somebody else to get a second opinion, make sure you didn't miss anything important.

6.2. rectifying out-of-specification process outcomes

At its core, problem solving is a methodical four-step process. You may even recall these steps from when you were first introduced to the Scientific Method.

- First, you must define out-of-specification process outcomes. What is its cause? What are the signs there's a problem at all?
- Next, you identify various options for solutions. What are some good ideas to solve this?
- Then, evaluate your options and choose from among them. What is the best option to solve the problem? What's the easiest option? How should you prioritize?
- Finally, implement the chosen solution. Does it solve out-of-specification process outcomes? Is there another option you need to try?

Self-Check – 6	Written test

Name……ID…… Date…….

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

Test 1: choose the best answer for the following question

1 which of the following is out of specification method?(3point)

. A Real chick B problem identification C Investigation D all

2 which one is Problem Identification?(3point)

A Look at the symptoms of the problem B investigation C chick D all

Test I: Short Answer Questions

1. Write types of 3 step rapid out-of-specification process outcomes identification method? **(5 points)**

2. Mention at least 3 Problem Identification techniques? **(2points)**

3. Describe Steps of rectifying out-of-specification process outcomes? **(5 points)**

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

You can ask you teacher for the copy of the

Information sheet 7- Maintaining the work area

7.1 Maintaining the work area

The workplace may be permanently fixed, movable or even temporary based on one off work (promotional activities), seasonal work types, work involving one off situation with different duration (hours, days or weeks).

Maintain safe work area

a. Access

Consideration should be given to the ability of a person to access the amenities and facilities. The means of access to the facility or amenities should be safe and accessible for all persons who require access.

b. Maintenance

The work environment, facilities and amenities are required to be maintained in a safe and healthy condition, and need to be hygienic, secure and in a serviceable condition. This includes replenishment of consumables, repair of broken or damaged furnishings and equipment and ensuing cleanliness of these areas.

c. 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.

d. 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.

In particular:

- Entries and exits should be slip resistant under wet and dry conditions

- Any walkways, boundaries or pathways shall be marked with 50mm wide with a contrasting color e.g. white or yellow
- Open sides of staircases should be guarded with an upper rail at 900mm or higher and a lower rail
- Handrail should be provided on or at least one side of every staircase
- Separate entry and exits for mobile equipment e.g. forklifts or trucks, and pedestrians are to be provided
- Power operated doors and gates should have safety features to prevent people from being stuck or trapped.
- Location of exits should be clearly marked and signs posted to show direction of exit doors to aid emergency evacuation.

e. 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.

In determining how much space is required, the following should be considered:

- The physical actions needed to perform the task
- The need to move around while working
- Whether the task is to be performed from a sitting or standing position
- Access to workstations
- The equipment to be handled and the personal protective equipment that may be worn to perform the work.
- Environmental factors including heat or noise may require an increase to the space, as will work activities that involve manual tasks or the use of equipment.

7.2. 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.

In general:

- Floors shall be free from slip or trip hazards e.g. cables, uneven edges, broken surfaces
- Floor surfaces shall have sufficient grip to prevent slipping, especially in areas that may become wet or contaminated
- Anti-fatigue matting, carpet, shock absorbent underlay, cushion backed vinyl shall be provided for workers where static standing occurs
- Carpet shall be properly laid without loose edges or ripples and should be well maintained.

Self-Check – 7	Written test

Name…… ID…… Date…….

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

Test I: say true or false for the following question

1 layout is not necessity for the workshop**. (**3point)

Test II: Short Answer Questions

1. What are the requirements a person should ensure during conducting work in accordance with workplace guideline? (4pts)
2. Write at list five items that a work environment, facilities and amenities are provided for basic health and welfare of employees, contractors and visitors? (3pts)

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

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

Operation sheet 1	heating procedure

Procedure

Step 1 Use personal protective equipment/PPE
Step 2 prepare Mise-en-place
Step 3 making candy, place a 1- or 2-quart saucepan over medium-high heat until the pan is warm, not hot.
Step 4 Add the sugar and cook, stirring occasionally with a wooden spoon, until all of it has melted.
Step 5 Clamps on a Candy Thermometer.
Step 6 The sugar syrup will take on a light golden brown at 320 degrees F or Whatever the recipe indicates
Step 7 quickly remove the pan from the heat and shock it in ice-water bath by immersing pan half way for 5 seconds.
Step 8 Remove the caramel to either a greased marble slab, silpat mat or a heat-proof bowl.

Operation sheet 2	cooling procedure

Procedure

Step 1 Use personal protective equipment/PPE
Step 2 Check the product cooling equipment/ machine
Step 3 Check cooling temperature and time
Step 4 Monitor the product
Step 5 Operate the cooling process

LAP TEST	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 **1hours**. The project is expected from each student to do it.

Task-1 heating procedure
Task- cooling procedures

LG #68	LO3: Shut down the process

Instruction sheet

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

- Identifying shutdown procedure
- Shutting down the Process
- Identifying and reporting maintenance requirements

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

- Identify shutdown procedure
- Shut down the Process
- Identify and report maintenance requirements
- Apply food safety procedures

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 Identifying shutdown procedure

1.1 Identifying shutdown procedure of high and low boiler.

Shutdowns procedures are appropriate to the process and workplace production requirements, including emergency and routine shutdowns and procedures to follow in the event of a power outage Isolation, lock out and tag out procedures and responsibilities are appropriate Condition.

1.1.1 After Cleaning machine includes:

a) Re-operational checks

b) Start-up

c) Shut down and minor servicing to enterprise requirements.

The following point should be taken into account to identify shutdown:

- Shut down must be conducted using the standard procedures established for the Machine or equipment (not emergency procedures or other shortened/simplified method).
- Pull plug or throw switch to off position before cleaning or adjusting any machine and away from moving parts. Wait until machine stops before moving coffee.

1.1.2 The following points are shutdown procedure of high and low boiler.

- Equipment is dried and cleaned as per manufacturer's specifications and infection control procedures.
- Cleaning agents, polishes and cloths are stored in accordance with manufacturer's specifications and relevant health and safety requirements

- Cleaned equipment is stored in a manner that will maintain its function and is readily accessible for re-use

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)
- Re-circulating 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

Fig 1 high boil machine

1.3 Lock- out/tag – out: - refers to the placement of locks and/or tags on machinery or machinery controls to prevent the machine from operating. By locking - out the energy source(s) to the machine or controls, workers can safely complete job tasks without being exposed to a hazard due to inadvertent starting of equipment. Locking - out a piece of equipment is generally more effective at protecting workers from unexpected machine operation than is tagging it out. A lock physically prevents the machine from being turned- on, whereas a tag is tied on with a string.

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 choose the best answer for the following question (each 2 point)

1 which of the following is cleaning machine techniques?

Re-operational checks B Start-up C cleaning D a &b E all

2 One is true about shutdown process?(3point)

A shutdown is render system B material C shut down is the process of closing D all E a & c

Test I: Short Answer Questions

1. What is shut down process? (5 points)
2 Describe log-out/tag-out (5pts)
3 Write steps taken in unit shut down of schedule shut down? (5 points)

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

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

Information sheet 2- Shutting down the process according to workplace procedures.

2.1. Shutting down the process according to workplace procedures.

Shut down process is a term used to describe the process of closing all systems of process control systems. Cleaning is done on handling equipment, storage facilities, buildings and surrounding grounds.

Shutdown Processes is used for:

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

2.3 Environmental Issues related to Shutting down process

Controls Relevant to the Process Include.

- inclement weather during operations
- machinery breakdowns
- power outages
- storm damage to equipment and site

➢ Shut down the process May include**.**

- Clean and sanitize equipment
- Take samples and conduct test
- Carry out routine maintenance

- **Shutting down boiler**

When a boiler has to be removed from service for maintenance, inspection, or layup, the following procedure should be followed:

1. Before shutting the boiler down, give it a good blow down to remove as much sediment as possible. Stop when the drain runs clear.
2. Put the boiler steam pressure control in manual mode, and slowly reduce The firing rate. Watch the main steam header pressure to make sure that the other boilers are taking up the load. Do not reduce the firing rate below that necessary to maintain a stable flame.
3. When the boiler is at the minimum firing rate the fuel can be shut off at the main gas cock. Alternatively, this is often a good time to test the low water level shutdown switch, or some other boiler interlock. If this method is chosen make sure you note it in the logbook.
4. Allow the fan to post-purge the furnace with a reduced air flow, and then shut the fan down. Be particularly careful not to let the fan supply large a mounts of cold air into the furnace in the winter.
5. Close the boiler header stop valve.

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: choose the best answer for the following question

1 which of the following is Shutdown the process? (2point)

A Carry out routine maintenance B Take samples C conduct test D all

Test I: Short Answer Questions

1. Define shut down processes (3 points)
2. Uses of shutdown processes (3pts)
3. mention environmental issue relevant to the processes (4pts)

Note: **Satisfactory rating -≥ 6 points Unsatisfactory - below 6oints**

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

Information sheet 3- Identifying and reporting maintenance

3.1 Definition of maintenance requirement

Maintenance requirements are the processes of maintaining work area to meet housekeeping standards and Respond to and/or report equipment failure within level of responsibility.

3.2 Purposes of Maintenance Requirement

Maintenance requirement requires that: all sorting and boiling equipment be maintained in an efficient state, in efficient order and in good repair. Where any machinery has a maintenance log, the log is kept up to date; and that maintenance operations on work equipment can be carried out safely. It is Department of the machinery that condition-based maintenance.

3.3. Compression of condition based maintenance and planned maintenance

3.3.1. condition based maintenance (CBM)

- Improved system reliability
- Decreased maintenance costs
- Decreased number of maintenance operations causes a reduction of human error influences

➢ **Its disadvantages are:**

- High installation costs, for minor equipment items often more than the value of the equipment
- Unpredictable maintenance periods cause costs to be divided unequally.
- Increased number of parts (the CBM installation itself) that need maintenance and checking.

3.3.2. Planned maintenance

Planned maintenance is maintenance that is carried out during quiet periods, overnight or when areas are closed. It is planned in advance and all relevant staff is notified.
It may include items such as:

- Replacement of carpets
- Replacement of beds or furniture
- Re-upholstery of chairs
- Window cleaning
- Re-grouting of bathroom tiles
- Carpet cleaning Stripping and sealing of large floor areas.
- Dry cleaning of curtains
- Resurfacing of baths Painting
- Wall papering Cleaning of high areas
- Cleaning of grease traps (kitchens)
- Special project cleaning.

Fig Planned Maintenance

3.4 Routine maintenance may include:

- Regular checking of equipment.
- Replacing consumables.
- "in-house" cleaning and servicing of equipment according To manufacturer's guidelines
- Periodic servicing by qualified or manufacturer approved technician.

List of Machinery and Equipment that need Maintenance Requirements

- sugar mixer
- panel board
- pump
- Automatic moulding machine
- Screw conveyor

To Identify/reporting maintenance requirements consider the following points:

- Check manufacturer's instructions to determine recommended maintenance schedule
- Check fault and maintenance history to determine adequacy of current regime and special requirements
- Determine criticality of machine to production/business
- Develop maintenance schedule/requirements for machine
- Liaise with all relevant stakeholders to ensure schedule is appropriate
- Report outcome to appropriate personnel.

Fig 2 Reporting Maintenance requirements

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: Say true/False for the following question

1. Maintenance helps to protect the capital investment and ensures an effective And economical expenditure (2point).

Test II: Choose the best

1. Which of the following is true about properly performed maintenance (2point)?
   A) Contribute to gaining a competitive advantage.
   B) Enhances customer satisfaction that is often directly dependent on the Reliability, flexibility and speed of suppliers
   C) Increasing satisfaction through better products or services
   D) All
   E)

Test II: Short answer

1. Write importance of Maintenance (4point)

_____

_____

_____

Note: Satisfactory rating ≥4points Unsatisfactory - below 4 points

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

Information sheet 4- Applying food safety procedures

4.1. Applying food safety procedures

Food is any substance consumed to provide nutritional support for the body. It is usually of plant or animal origin, and contains essential nutrients, such as carbohydrates, fats, proteins, vitamins, or minerals.

4.1.1. Concepts of Food safety

Food safety refers to a scientific discipline handling, preparing, and storing food in ways to best reduce the risk of individuals becomes sick from food borne illness. This includes a number of routines that should be followed to avoid potentially severe health hazards such as;

- Contaminants, toxins and micro-organisms that can cause undesirable reactions in Food the body when such foods are eaten.
- harmful bacteria, poison and other foreign bodies
- spoilage of the food
- For some foods: thoroughly cooked to destroy any harmful bacteria present
- spoilt and/or contaminated
- Food borne illness can be dangerous,

Fig 1 Food Safety at Home

4.1.2. Basic principles of food safety

Food Safety Principles an important part of healthy eating is keeping foods safe. Food may be handled numerous times as it moves from the farm to homes. Individuals in their own homes can reduce contaminants and help keep food safe to eat by following safe food handling practices. Four basic food safety principles work together to reduce the risk of food borne illness—Clean, Separate, Cook, and Chill.

A. **Cleaning** is the removing un wanted particles (dust, dirt or other contaminants from food and utensils or equipment

B. Hands wash

Hands should be washed before and after preparing food, especially after handling raw seafood, meat, poultry, or eggs, and before eating. In addition, hand washing is recommended after going to the bathroom, changing diapers, coughing or sneezing, tending to someone who is sick or injured, touching animals, and handling garbage. Hands should be washed using soap and water. Soaps with antimicrobial agents are not needed for consumer hand washing, and their use over time can lead to growth of microbes resistant to these agents. Alcohol-based (≥ 60%), rinse-free hand sanitizers should be used when hand washing with soap is not possible.

Hand sanitizers are not as effective when hands are visibly dirty or greasy. Wash Hands with Soap and Water .Wet hands with clean running water (warm or cold), turn off tap, and apply soap. Rub hands together to make lather and scrub the back of hands, between fingers, and under nails for at least 20 seconds. If you need a timer you can hum the “happy birthday” song from beginning to end twice. Rinse hands well under running water. Dry hands using a clean towel or air dry them.

c. wash the Surfaces

Surfaces should be washed with hot, soapy water. A solution of 1 tablespoon of unscented, liquid chlorine bleach per gallon of water can be used to sanitize surfaces. All kitchen surfaces should be kept clean, including tables, countertops, sinks, utensils, cutting boards, and appliances. For example, the insides of microwaves easily become soiled with food, allowing microbes to grow. They should be cleaned often.

- Keep Appliances Clean
- At least once a week, throw out refrigerated foods that should no longer be eaten.
- Cooked leftovers should be discarded after 4 days; raw poultry and ground meats, 1 to 2 days.
- Wipe up spills immediately—clean food-contact surfaces often.

❖ Components of basic food safety

- Maintaining personal hygiene while storing and handling food
- Preventing contamination, cross contamination
- Reporting and preventing pest infestation
- Safe disposal of waste
- Safe handling and storage of cooked and un-cooked food
- Use of personal protective equipment

❖ Personal hygiene practices

Good personal hygiene is essential for food safety. Disease-causing bacteria may be present on the skin and in the nose of healthy people. All food handlers must therefore maintain a high standard of personal hygiene and cleanliness in order to avoid transferring pathogens to foods.

Fig 2. Personal hygiene

Food safety procedures;

Clean - wash hands and surface often.

Separate –don't cross contaminate

Cook- cooks to the right temperature

Chill- refrigerate promptly

Measuring – portioning the ingredient

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: Say true/False for the following question

1. Good personal hygiene is essential for Environment. (2point)

2 Food Safety Principles is not important part of healthy. (2point)

Test II: Choose the best for the following question

1 which of the following is Components of basic food safety?(3point)

A Safe disposal of waste B Use of personal protective equipment

C Reporting and preventing pest infestation D all

Test III: Short answer

1. Write importance of food safety (3 point)

_____

_____

_____

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

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

Operation sheet 1	Techniques of shutdown procedures of boiler machine

Procedure

Step1. Apply Safety first

Step2. Follow appropriate shutdown procedure

Step3. Select tools and equipment for cleaning (using water/cleaning agent)

Step4. Identify shut down process

Step5. Observe Lock out Tag out procedure

Step6 .Check which systems be isolated or shut down

Step7.Check all switches to see that they are off before plugging into the outlet.

Operation sheet 2	Food safety

Procedure

Step 1 Wear PPE.

Step 2 wash hands with soap and water.

Step 3 clean sweep refrigerated foods in once week.

Step 4 separate foods when shopping.

Step 5 cook the food at right temperature.

Step 5 kept the foods into the refrigerator in appropriate temperature.

Step 6 separate foods when serving.

LAP TEST	Performance Test

Name……ID……..Date……

Time started: _____ Time finished: _____

I Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **1** hour. The project is expected from each student to do it.

Task -I Techniques of shutdown procedures of boiler machine

Task -II Food safety.

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AKNOWLEDGEMENT

We wish to extend thanks and appreciation to the many representatives of TVET instructors and respective industry experts who donated their time and expertise to the development of this Teaching, Training Learning Materials.

We would like also to express our appreciation to the TVET instructors and respective Regional TVET Bureau, TVET College/ Institutes, UNESCO Project (best education for African rise (BEAR)) and Federal Technical and Vocational Education and Training Agency (FTVET) who made the development of this Teaching, Training Learning Materials with required standards and quality possible.

This Teaching, Training Learning Materials was developed on September 2020 at Bishoftu, Federal management institute ETHIOPIA

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