Cereal Processing

Level-III

Based on October 2019, Occupational standards

Version 2

Module Title: Processing dough

LG Code: IND CRP3 M05 LO (1-3) LG (16-18)

TTLM Code: IND CRP3 TTLM 0321 V1

March 2021

Bishoftu Management Institute

United Nations Educational, Scientific and Cultural Organization

Republic of Korea Funds-in Trust

Contents

LG 16	LO 1- Scale and mould dough

Instruction sheet

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

- Scaling typical ingredients and preparing dough
- Scaling dough
- Molding dough to provide initial shape
- Laminating, chilling or filling dough
- Identifying, removing or rectifying and/or reporting unacceptable scaled and molded dough

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:

- Scale typical ingredients and preparing dough
- Scale dough
- Mold dough to provide initial shape
- Laminate, chill or fill dough.
- Identify, remove or rectify and/or report unacceptable scaled and molded dough

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 Scaling typical ingredients and preparing dough

1.1 Introduction

Dough is a thick, malleable, sometimes elastic paste made out of any grains, leguminous or chestnut crops. Dough is typically made by mixing flour with a small amount of water and/or other liquid, and sometimes includes yeast or other leavening agents as well as other ingredients such as various fats or flavorings. The process of making and shaping dough is a precursor to making a wide variety of foodstuffs, particularly breads and bread-based items, but also including biscuits, cakes, cookies, dumplings, flatbreads, noodles, pasta, pastry, pizza, piecrusts, and similar items. Dough are made from a wide variety of flours, commonly wheat but also flours made from maize, rice, rye, legumes, almonds, and other cereals and crops used around the world.

1.2 Typical ingredients of dough

1.2.1 Flour

It is the main ingredient used in making breads. Usually strong flours are used in bread making. Whole wheat flours have lesser concentration of gluten as the bran content is increased.

Bread flour is a hard wheat flour with about 12 percent protein. Bread flour is used for yeast raised bread because the dough it produces has more gluten than dough made with other flours. Sufficient gluten produces a light loaf with good volume. Slices hold together, rather than crumble.

Cake flour is a soft wheat flour that is 7.5 percent protein. The lower gluten content causes products to have a tender, more crumbly texture that is desirable in cake.

All-purpose flour is blended during milling to achieve a protein content of 10.5 percent. This medium protein flour can be used for all baking purposes. If using all purpose flour in place of cake flour in a recipe, substitute 1 cup minus 2 tablespoons all-purpose flour for 1 cup cake flour.

Whole wheat flour may be substituted for part of the white flour in yeast and quick bread recipes, but the volume of the finished product will be reduced. Whole wheat flour contains the nutritious germ and bran as well as the endosperm of the wheat kernel. Bran particles cut through the gluten during mixing and kneading of bread dough, resulting in a smaller, heavier loaf. To substitute whole wheat flour in a white bread recipe, use half whole wheat and half bread flour for the best results. Wheat germ, though not a flour, is often used in place of part of the flour in recipes for flavor and fiber. Protein, vitamins, minerals, and polyunsaturated fats are concentrated in the germ of grain kernels. Wheat germ, preferably toasted, can be used in place of up to 1/3 of the flour in a recipe.

The following non-wheat grain products are often used in baked goods. They are rich in protein but most do not have the potential for developing gluten. For this reason, at least 1 cup of wheat flour should be used for every 1 cup of non-wheat flour so the product will not become too heavy.

Rye flour is often used in combination with wheat flour for bread. Light rye flour can be successfully substituted for 40 percent of wheat flour in a recipe without loss of volume. Medium and dark rye flours should be limited to 30 percent and 20 percent, respectively, of the total flour amount.

Triticale flour is a hybrid of wheat and rye. It has an average protein content higher than that of wheat flour. In yeast bread dough, triticale flour has better handling properties than rye flour because it will form gluten, but does not handle as well as wheat dough. For a good quality dough, ferment yeast dough made with triticale flour for a shorter period than wheat flour dough.

Oat flour has a relatively high protein content, 17 percent, but does not form gluten. Oat flour can be substituted for as much as 1/3 of wheat flour in bread. Corn meal is coarsely ground dried corn.

Corn flour is more finely ground corn. Both corn flour and corn meal contain 7-8 percent protein on a dry basis. Neither corn meal nor corn flour will form gluten. A grainy texture in

cornbread can be avoided by mixing the cornmeal with the liquid from the recipe, bringing to a boil, and cooling before mixing with the other ingredients.

Rice flour has about 6.5-7 protein and does not form gluten. For people who do not tolerate gluten, rice flour is an acceptable substitute for wheat, barley, rye or oat flours. In baked products, 7/8 cup of non-waxy rice flour can be used in place of 1 cup all purpose wheat flour.

Potato starch flour, another non-gluten forming flour is usually used in combination with other flours. It has a mild potato taste. For substitutions, 5/8 cup of potato flour can be used for 1 cup of all-purpose flour. Soy flour contains 50 percent protein and is used primarily to boost the protein content of baked goods.

Soy flour cannot form gluten and does not contain starch. Its use in large amounts affects the taste of baked goods and causes them to brown quickly. An acceptable substitution is to take 2 tablespoons flour out of each cup of flour in a recipe and add 2 tablespoons soy flour.

1.2.2 Water

Water is the most commonly used liquid in bread making. It moistens the flour and helps in forming the dough. It also aids in the baking process. Water performs the following three main functions in the bread dough.

- Helps hydrate and moisten the insoluble proteins.
- Disperses the yeast amongst the entire dough.
- Binds the flour and other ingredients into a dough.

It is observed that the water content in the dough greatly affects the rate of fermentation. The speed of fermentation is greater in ferment and dough process as compared to sponge and dough process, which have an increasing level of hydration. As the fermentation time increases it becomes essential to reduce the water content to effect a higher ripening of the dough. The amount of water present will also greatly affect the texture of the final dough obtained. Hard water has a higher alkalinity. As yeast works best in an acidic medium, fermentation can be slower in the initial stages if hard water is used. However as the fermentation proceeds the acids produced will neutralize this alkalinity and then the

fermentation will continue at a brisk pace. Also, the alkalinity and the mineral salts will tighten the gluten and thus the dough will be firmer.

Very hard water also has magnesium sulphate which has a retarding action on the yeast. Breads can be made with both hard and soft water, provided the physical adjustments are made. When the dough is needed for longer duration of time, the temperature in the dough increases due to friction.

This has to be watched carefully as the temperature of the dough should not go beyond 25°C for the yeast to start working. In such cases a baker often uses ice to make the dough. Ice keeps the fermentation activity of yeast at an ideal rate for gluten ripening.

The quantity used will vary depending upon the time of kneading of the dough or the friction factor, and the dough temperature required. Ice used must be in the form of flaked ice so that it is evenly distributed in the bread dough and causes an even cooling of the dough. It can be safely said that 5 kg of ice will be equivalent to 4 litres of water.

1.2.3 Yeast

Yeast is a single cell microorganism which causes the leavening in the dough. It converts the natural sugar in the flour into tiny bubbles of carbon dioxide that are trapped in the dough. During baking these bubbles expand to give the texture and lightness to the dough.

Yeast is available in two forms—dry and compressed. The ideal temperature for yeast to act is 25°C. The primary function of yeast is to change sugar into carbon dioxide so that the dough is aerated. When dispersed in water with yeast food, the yeast exudes an enzyme that changes sucrose into dextrose, which is then absorbed by the yeast cell. Inside the cell, this is broken down into carbon dioxide and other by-products. Yeast also has enzymes which change protein into simpler compounds which can pass through the yeast cell membrane.
Yeast works best within a temperature range of 25 to 40°C. Above this, fermentation becomes rapid but the yeast gets weaker successively and is finally killed at 70°C. At this temperature, yeast is completely retarded though it is not damaged. Yeast can never dissolve completely in water, though it is just dispersed well into it. One could use a whisk to effectively distribute.

Compressed yeast must be cold to touch and must possess a creamy colour breaking with a clean fracture. If it is light in colour, and is dry, warm, with a pungent odour, it is in poor condition and the quality of bread might not be good. If it is dark brown in colour with a soft sticky consistency and an unpleasant odour, it is unsuitable for use.

1.2.4 Salt

The main function of salt is to control the action of yeast as it slows down the fermentation process. It should be mixed with flour for best results. It also provides flavor to the bread. It also affects the quality of the crumb, crust, and colour of the baked product.

So salt mainly performs the following functions:

- Imparts flavor
- Gives stability to gluten
- Controls the rate of fermentation
- Retains and of moisture and
- Affects the crust colour and crumb, due to control on the rate of fermentation.

1.2.5 Sweeteners

Sucrose, (table sugar) has many functions in food other than providing sweetness. In small amounts, added sugar helps yeast begin producing gas for raising yeast dough. Sugar in large amounts slows yeast fermentation; in a very sweet dough the rising time is longer. Sugar tenderizes dough and batter products and may help the baked product to brown. Moisture is retained better in sweetened breads than in unsweetened breads. It is the sugar in cookie dough that causes spreading to occur during baking. Reducing the amount of sugar by more than 1/3 can cause loss of tenderness, moisture, browning, and sweetness. The volume may increase in a bread recipe when sugar is reduced.

Fructose in crystal form is nearly twice as sweet as sucrose and is more expensive. Fructose attracts more water than sugar, therefore, fructose sweetened products tend to be moist. Baked products made with fructose will be darker than if they were made with sucrose.

Honey is sweeter than sugar because it contains fructose. Honey has a distinctive flavor. When using honey in place of sugar, use 3/4 cup plus 1 tablespoon honey in place of 1 cup sugar and reduce the other liquid ingredients by 2 tablespoons. Even when liquid is reduced,

a product that contains honey will be moist because the fructose absorbs moisture from the atmosphere. Too much honey may cause the product to become too brown.

Molasses imparts a dark color and strong flavor to baked foods. It is not as sweet as sugar. When using molasses in place of sugar, use 1-1/3 cups molasses for 1 cup sugar and reduce the amount of liquid in the recipe by 5 tablespoons. Because molasses is more acidic than sugar, it may be necessary to add 1/2 teaspoon baking soda for each cup of molasses used in substitution for sugar. Replace no more than 1/2 the sugar called for in the recipe with molasses.

The following artificial sweeteners are available for home use. They provide sweetness to homemade foods but lack the browning, tenderizing, and moisture retaining properties provided by table sugar. Specially formulated recipes are often needed to make a product with acceptable texture and appearance when using artificial sweeteners. Because the different low-calorie sweeteners vary in sweetness and bulk, package directions must be followed for the amount to use in place of sugar.

Saccharin is a heat stable non caloric sweetener that, in its pure form is 200-300 times as sweet as sucrose. Bulking agents are added to saccharin products to aid in measuring. Saccharin has a bitter aftertaste.

Acesulfame K is a very low calorie sweetener that is 200 times as sweet as sucrose. It is heat stable so it can be used in baked goods. For improved texture in baked products, use acesulfame K in combination with granulated sugar. Acesulfame K reportedly has no unpleasant after taste.

Aspartame, commonly known as Nutral sweet is not heat stable so it is not an appropriate sweetener for baked goods

1.2.6 Improvers

Flour is of variable quality and hence it becomes necessary at times to add improvers to the dough to bring the final product to a set standard. Bread improvers may be divided into three main categories. These include:

- Those of mineral nature, used by the miller.
- Those of organic nature, mainly enriching agents.
- Those of the mineral and organic categories which are also foods for yeast.

Mineral improvers are popular because they increase the yield of the bread by necessitating the use of extra water. Some of the mineral improvers have a slight drying effect on the crumb.

1.3 Preparation of dough

Techniques used in dough production depend on the type of dough and final product.

For yeast-based and sponge (such as sourdough) breads, a common production technique is the dough is mixed, kneaded, and then left to rise. Many bread doughs call for a second stage, where the dough is kneaded again, shaped into the final form, and left to rise a final time (or proofed) before baking. Kneading is the process of working a dough to produce a smooth, elastic dough by developing gluten. This process is both temperature and time-dependent; temperatures that are either too hot or too cold will cause the yeast to not develop, and rising times that are either too short or too long will affect the final product.

There are different types of dough are prepared in cereal bakery manufacturing those are:

- Pasta and other noodle dough
- Doughs for biscuits and many flatbreads
- Fried dough
- Pancakes, waffles, some kinds of bar cookies such as brownies, and many cakes and quick breads

Pasta is typically made from a dry dough that is kneaded and shaped, either through extrusion, rolling out in a pasta machine, or stretched or shaped by hand (as for gnocchi or dumplings). Pasta may be cooked directly after production (so-called "fresh pasta") or dried, which renders it shelf-stable.

Doughs for biscuits and many flatbreads which are not leavened with yeast are typically mixed but not kneaded or left to rise; these doughs are shaped and cooked directly after mixing.

While breads and other products made from doughs are often baked, some types of dough-based foods are cooked over direct heat, such as tortillas, which are cooked directly on a griddle. Fried dough foods are also common in many cultures.

Pancakes, waffles, some kinds of bar cookies such as brownies, and many cakes and quick breads (including muffins and the like) are often made with a semi-liquid batter of flour and liquid that is poured into the final shape, rather than a solid dough. Unlike bread dough, these batters are not stabilized by the formation of a gluten network.

1.3.1 Sifting of flour

Sifting is a process that breaks up any lumps in the **flour** and aerates it at the same time by pushing it through a gadget that is essentially a cup with a fine strainer at one end.

Some industrial strainers available are simplex basket strainers, duplex basket strainers, strainers and Y strainers. Simple basket strainers are used to protect valuable or sensitive equipment in systems that are meant to be shut down temporarily. Some commonly used strainers are bell mouth strainers, foot valve strainers, basket strainers. Most processing industries (mainly pharmaceutical, coatings and liquid food industries) will opt for a self-cleaning strainer instead of a basket strainer or a simplex strainer due to limitations of simple filtration systems. The self-cleaning strainers or filters are more efficient and provide an automatic filtration solution.

Figure 1. Flour sieve

Sieving is a simple technique for separating particles of different sizes. A sieve such as used for sifting flour has very small holes. Coarse particles are separated or broken up by grinding against one another and the screen openings. Depending upon the types of particles to be separated, sieves with different types of holes are used. Sieves are also used to separate

stones from sand. Sieving plays an important role in food industries where sieves (often vibrating) are used to prevent the contamination of the product by foreign bodies.

Table 1- Aperture of sieves & the required particle size distribution of samples.

Aperture of sieves μm	Sample passing through sieve %
710	100
500	95-100
210-200	80 or less

- The particle size distribution should be checked regularly, using a well-mixed ground sample & a suitable laboratory sifter.
- The grinding method to prepare ground sample from wheat or semolina influences the results of the gluten determination.
- Different mills produce different ground sample fractions of different composition, which will cause variation in dough formation and the washed out gluten.

2.3.1 Mixing

One of the goals of mixing is to distribute all of the ingredients evenly, so the yeast has a level feeding ground and there are no surprise pockets of salt. Mixing also begins to develop the strength of the dough. As you mix, you'll start to notice the shaggy mass evolve into long strands of gluten, and when mixing by hand you can actually see and feel the structure of gluten sheets building. Over-mixing (which normally only occurs when a mixer is used) can both break down the structure of the dough and incorporate too much air, which can bleach out the flavor and color of bread.

An integral part of all dough bread making is the formation of a smooth and homogeneous dough with a developed gluten structure.in some bread making processes dough development continues during resting after mixing while in others full development is achieved

during the mixing process itself. Whatever the method by which dough development is achieved the next stage in bread manufacture is the subdivision of the bulk dough (dividing) and the shaping of the individual dough pieces (moulding) to conform to the requirements of the bread variety being made. Shaping may be a multi-stage operation and may involve a further resting period between moulding stages (intermediate or first proof). Once finally formed the dough pieces commonly pass on to be proved before baking. Before the introduction of machinery, dough the world over was made by hand mixing of the ingredients and then by kneading the mixture until a dough was created.

We can summarize mixing requirements as the following:

- To disperse uniformly the recipe ingredients.
- To encourage the dissolution and hydration of those ingredients, in particular the flour proteins.
- To contribute energy to the development of a gluten (hydrated flour protein) structure in the dough.
- To incorporate air bubbles within the dough to provide gas nuclei for the carbon dioxide generated from yeast fermentation and oxygen for oxidation and yeast activity.
- Provide a dough in a suitable form for subsequent processing.

3.3.1 Kneading or folding

Kneading the dough furthers gluten development by aligning the strands of gluten that bond to form the structural foundation of the bread.

During kneading of dough over kneading is not recommended because of over-kneading the dough is seeing tears in the outer surface. This breaks the gluten strands and disrupts a healthy fermentation. Kneading has been an iconic part of bread making for as long as anyone can remember, yet folding the dough can be a simpler and more efficient technique.

Folding the dough aligns the gluten strands into sheets of dough and develops strength. It prevents the collapse of air pockets and avoids overworking the gluten, producing bread with a tenderer crumb. This technique is good for especially wet doughs or doughs made with weak flours and can take the place of kneading.

4.3.1 Dough Dividing

After mixing, dough dividing is the next step in a bread production plant. Dough dividing implies the transformation/portioning of bulk or large masses of dough into countable or single pieces of dough that can be better handled and/or manipulated throughout the production line. Dough dividing is also the first step in the make-up stage.

It can be carried out manually or mechanically to consistently produce:

- Desired dough size
- Correct dough shape
- Set dough weight
- Dough texture for entry into the rounding step

Dough pieces are divided volumetrically. This means, the bulk mass of dough is conveyed via a screw feeder. The rotating speed of the screw or dough pump determines the rate or mass flow of dough to be divided. The volumetric processing makes dough consistency and density vital factors for an accurate operation.

The dough is cut or divided into single pieces either by:

- Filling a chamber or barrel with a bulk mass of dough, and then cutting off and pushing the excess (piston dividing)
- Forcing a bulk mass of dough through an orifice at a fixed rate, and cutting protruding pieces from the end at regular intervals (extrusion and knife dividing)

The specific weight of the dough pieces are usually set 13–15% heavier than the finished product weight to compensate for:

- Fermentation losses caused by yeast metabolism
- Baking losses due to evaporation of water and ethanol solutions
- Losses during cooling due to evaporation of water

This is a key adjustment since the product must comply with labeling regulations and conform with in-house weight checks before being shipped to customers.

Dough dividing is essential for the production of yeast-leavened bakery products such as:

- Buns

- Rolls
- White pan bread
- Whole wheat pan bread

Self-check 1	Written test

Name…… ID…… Date…….

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

Chose the correct answer

1. Which one of the following is not typical ingredient for dough

   A. Yeast B. flour C. D. water none

2. Salt are mainly performs the following functions except

   A. Imparts flavor
   B. Gives stability to gluten
   C. Controls the rate of fermentation
   D. All

3. _____Is a hard wheat flour with about 12 percent protein

   A. Whole wheat flour
   B. Cake flour
   C. Bread flour
   D. All-purpose

Short answer

1. What is dough?
2. List ingredients' of dough

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

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

Information Sheet 2- Scaling dough

2.1. Introduction

Scaling and benching refers to the step that comes after fermentation where dough divided into separate loaves, pre-shape them, and let them rest for a period of time.

A baking scale, also known as a catering scale, is a weighing machine used by bakers and caterers for measuring food ingredients. There are many types of baking scale on the market, from digital kitchen or cooking scales for personal use to commercial catering scales and check weighers. Scales are useful for basic dough portioning and for weighing out ingredients on a small scale, they will not have the same level of precision as more specialist scales. Professional baking scales tend to offer higher precision, higher weight capacities as well as a whole host of additional smart weighing features such as the ability to store and recall recipes. Patisseries and commercial bakeries need to measure large quantities of ingredients when mixing batches of baked goods. A professional baking scale can offer greater precision than the average digital kitchen scale, and some varieties feature trade approvals required for selling baked goods by weight.

2.2. Dough scaling

Weighing scales help ensure dough consistently turn out the same for each batch. A standardised production process and using the same recipe means the finished product will be similar every time, which means customers can expect the same product when they return. Dough dividing/scaling is a process that divides bulk dough into consistent smaller dough weights. After mixing, dough dividing is the next step in a bread production plant.

Dough dividing implies the transformation/portioning of bulk or large masses of dough into countable or single pieces of dough that can be better handled and/or manipulated throughout the production line. Dough dividing is also the first step in the make-up stage.
It can be carried out manually or mechanically to consistently produce:

- Desired dough size
- Correct dough shape
- Set dough weight

- Dough texture for entry into the rounding step

Figure 2. Automatic dough scale

Dough dividing is also called scaling or portioning. The bulk dough is divided to smaller, final weights. This step is used when making more than one loaf of bread, or many rolls
Dough pieces are divided volumetrically. This means, the bulk mass of dough is conveyed via a screw feeder. The rotating speed of the screw or dough pump determines the rate or mass flow of dough to be divided. The volumetric processing makes dough consistency and density vital factors for an accurate operation.

The dough is cut or divided into single pieces either by:

- Filling a chamber or barrel with a bulk mass of dough, and then cutting off and pushing the excess (piston dividing)
- Forcing a bulk mass of dough through an orifice at a fixed rate, and cutting protruding pieces from the end at regular intervals (extrusion and knife dividing)
- The specific weight of the dough pieces are usually set 13–15% heavier than the finished product weight to compensate for:
- Fermentation losses caused by yeast metabolism
- Baking losses due to evaporation of water and ethanol solutions
- Losses during cooling due to evaporation of water

This is a key adjustment since the product must comply with labeling regulations and conform with in-house weight checks before being shipped to customers.

Dividing is essential for the production of yeast-leavened bakery products such as:

- Buns
- Rolls
- White pan bread
- Whole wheat pan bread

Newly developed dough weight system helps to bakers to control and adjust dough weight of the products while dividing process effectively.

Weight of the dough pieces coming from dough dividers are controlled while passing on the bands. If weight the dough pieces are not in between the required scale, system discharge the dough piece to a basket and remove it from the system. When the system determined such a fault, it communicates also with the divider and instruct it for more/less cutting. It means system control itself and makes the adjustments automatically.

Moving the discharged dough pieces to the divider hopper with a transport band also possible. As the weight control process has a low opinion for bakers and making time to time, it's very critical for the industrial bakers especially.

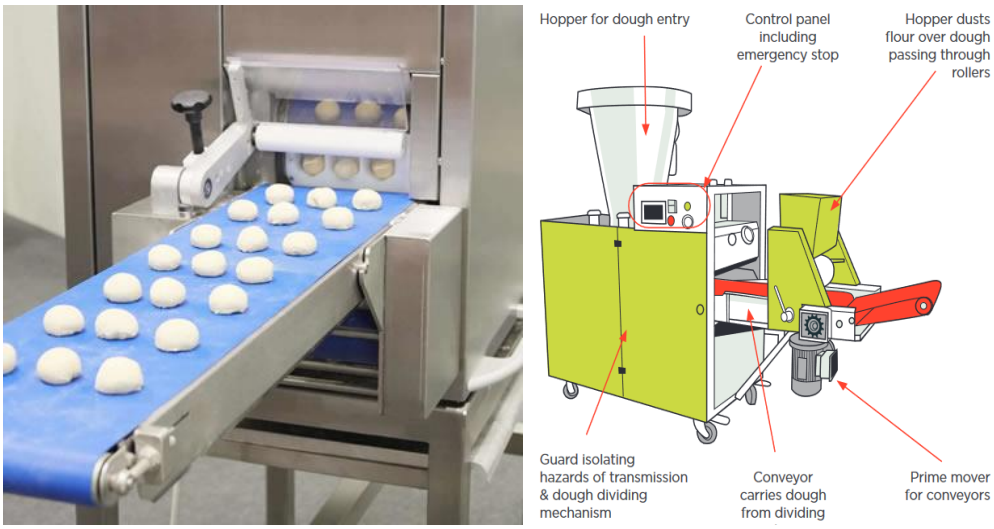


Figure 3. Dough dividers

Dough dividers intended for high-speed or large-scale production bakeries are equipped or fitted with automatic weight-checking mechanisms to check the dough at the beginning, middle, and end of each batch, or monitoring weight in a continuous fashion.

The running speed of dough dividers can be set manually by a human-machine interface (HMI) or centrally pre-set, according to the production line speed.

Common adjustments to dough dividers include:

- Conveying speed of screw or dough pump
- Conveying speed of belt
- Cuts per minute or knife speed
- Amount of pressure in the chamber or barrel (using manometer reading)

Equipment used for dough dividing

- Rotary/extrusion dividers
- Piston dividers
- Ram and knife dividers
- Pocket dividers
- Stress-free dividers

Bulk dough conveyed by a belt, sheeted to a certain thickness, and then cut lengthwise to produce a series of long ribbons. These are then gently portioned and rounded in the same piece of equipment. Stress-free dividers reduce or minimize the mechanical stress and strain forces that dough usually withstands during dividing.

Food safety and quality considerations

- Dough dividing equipment, as any other product-contact surface, should allow for maintenance, inspection, cleaning and sanitation activities to be performed easily, adequately and quickly.
- The amount of incoming bulk dough that divider can process should be appropriately balanced against the divider output to reduce dough shrinkage.
- The mass of dough being divided, should not be allowed to stand more than 20 minutes in the divider hopper or chute without making it to the rounding step. This is particularly

important in bakeries in which bulk fermentation does not occur, but only a specified floor time. As time passes, yeast activity, or carbon dioxide production, continues and could cause variations in dough density and weight distribution.

- If dough is held for prolonged periods of time without being divided, it runs the risk of becoming too gassy and warmer than the desired temperature.

Self-check 2	Written test

Name…… ID…… Date…….

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

True or false

1. Weighing scales help ensure dough consistently turn out the same for each batch
2. Before mixing, dough dividing is the next step in a bread production plant

Short answer

1. Write the way to adjust dough divider
2. List equipment used for dough dividing

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

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

Information Sheet 3- Molding dough to provide initial shape

3.1. Introduction

Dough moulding is the final step of the makeup stage in high-speed production of pan or loaf-type bread. It is a continuous mode operation, always receiving dough pieces from the intermediate proofer and placing them into pans. The function of moulding is to shape the dough piece, according to the bread variety being produced, so that it properly fits into pans. Dough moulding equipment can be set to achieve the desired shape with a minimum amount of stress and strain on the dough.

This production stage consists of four parts:

- Dividing the dough up into lumps.
- Letting the dough stand in balls.
- Shaping (moulding) the dough.
- Leaving to prove (fermentation).

The length of time spent on moulding is the most important factor.

3.2. Manual molding of dough into initial shape

Dough moulding is carried out by specialized equipment called moulders. A bread dough moulder has two basic components: a sheeter and a final moulder (dough former). These components influence the final shape and length of the dough pieces.

Sheeter

Coming from intermediate proofing, rounded dough pieces are sheeted or gradually flattened through a series of rollers in preparation for final moulding. The sheeter is usually comprised of 2–3 sets (in series) of Teflon-coated roller heads between which the dough piece is passed to gradually flatten the dough piece.

Sheeting applies stress forces (pressure) that help degas the dough piece so that large air cells developed during product transfer or intermediate proofing are reduced into smaller ones to achieve a fine grain in the finished product.

Roller sets are arranged in such a way that the gap/clearance is reduced gradually as the dough travels through them. This is critical to promote a controlled reduction of dough thickness. It would be impossible to flatten dough pieces in one single step without causing irreparable damage to the gluten and gas cell structure.

After passing through the top rollers, the dough piece becomes much thinner, larger, and oblong in shape. The flattened dough exiting the bottom rollers is ready to pass under the curling chain.

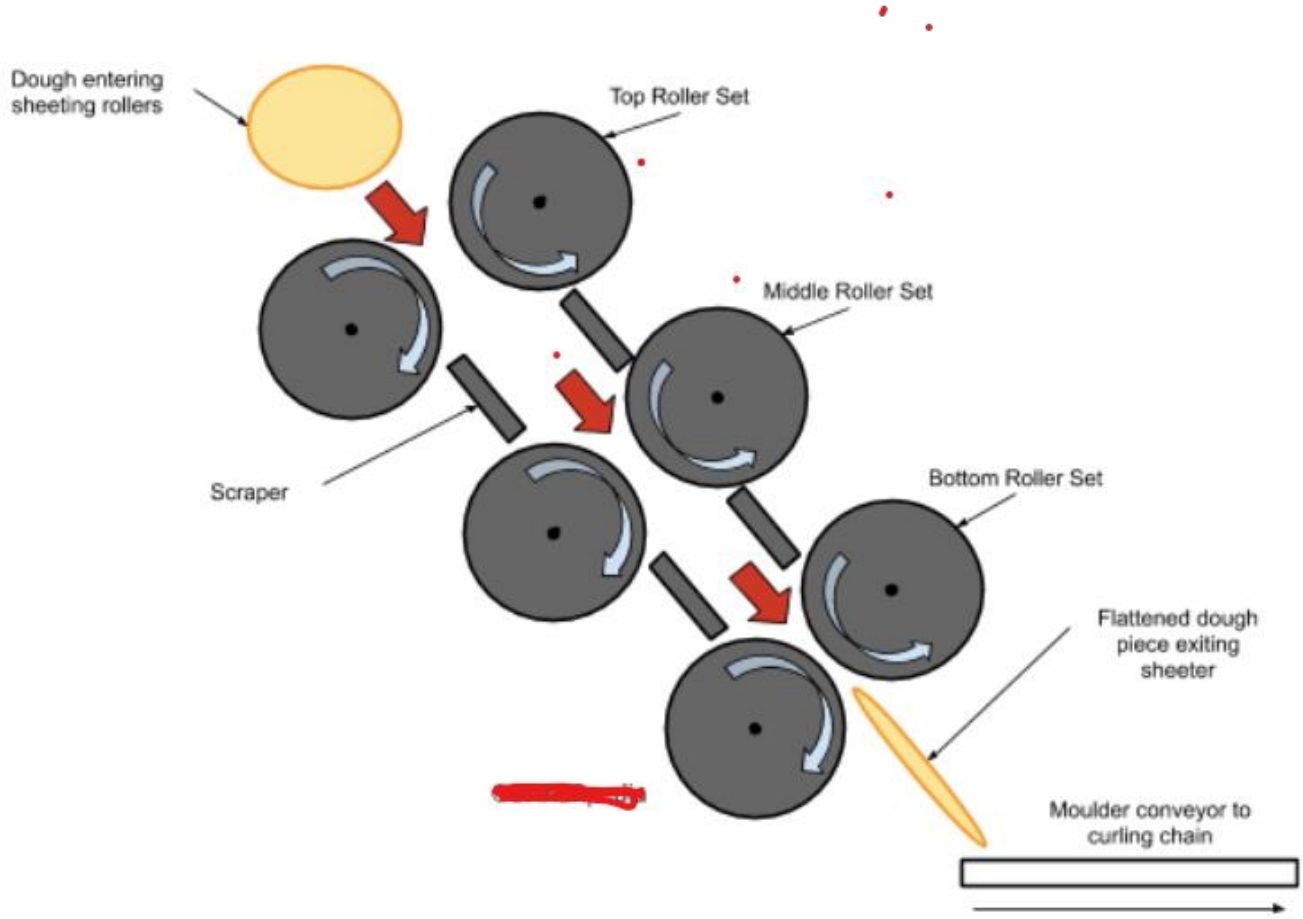


Figure 4: dough molder

3.3. Manual molding of dough into initial shape

In the typical life cycle of baking bread, there's a point where dough must be transformed into its final shape. But right before that, there's an often overlooked yet equally important step.Pre shaping dough is precisely what it sounds like; it sets the stage for successful final shaping

and there are many approaches a baker can take. Some people like to pull the dough together tightly and let it rest with the seam facing up. Others gently gather the dough and let to facilitate the final shaping of these unruly forms.

Pre shaping also gives us an extra chance to add strength to our dough.
Dough dividers are used in bakeries to divide high volumes of dough into quantities of equal size, using one or two pistons, or a knife. Dough dividers used for small batch production operate on manual rather than mechanical action, with hazards isolated during division of dough. During shaping the idea is to stretch and align the gluten so that it forms a kind of “skin” over the dough. When it rises for the final time the dough should get larger but pretty much retain its shape just as if you were blowing up a balloon.

The shape should also be maintained during baking. For long loaves or rolls the dough is spread out into a rectangle and rolled up or folded over itself. This aligns the gluten strands around the dough. You can think of this as creating hoops of gluten. For very long breads such as baguettes the dough then needs to be rolled out further to form a long “sausage”.
Round loaves and rolls are shaped by repeatedly folding the edges into the centre of the dough. Think of this as creating a gluten “cage” for the dough to rise in.

Self-check 3	Written test

Name…… ID…… Date…….

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

Fill the blank space

1_____ is the final step of the makeup stage in high-speed production of pan or loaf-type bread.

2._____And _____is basic components of bread dough moulder

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

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

Information Sheet 4- Laminating, chilling or filling dough

4.1 Introduction

Laminating dough refers to the process of folding butter into dough multiple times to create very thin alternating layers of butter and dough. The gluten in the flour also gets developed during the folding and rolling process. This is unlike other baked goods where butter is creamed in with the sugar and flour, so the result when baked is a pastry with hundreds of flaky, airy layers. Lamination is a process of layering fat into a pre-made dough by a series of rolling, folding and turning the dough. Purpose of lamination is to develop multiple layers of dough and fat that help leaven the dough and contribute to the crisp, tender and light characteristics of laminated products. Lamination of used in the process of cereal product like puff Pastry (no yeast/leavening), Croissant dough (has yeast) and Danish dough (has yeast). The two most common types of laminated dough are:

- Puff pastry and
- Croissants.

Puff pastry is the simplest form of laminated dough, with just butter folded into a basic dough of flour, water, and salt. Croissants take it one step further and add yeast and milk to the dough, which make the pastries richer, rise more, and end up more bread-like. Danishes, palmier cookies, kouign amann, and sticky buns are also pastries made with laminated dough. Laminated versus Non-laminated In the pastry world, the final step of categorization comes down to non-laminated and laminated doughs. These are often not confined by their leavened state, as a non-laminated or laminated dough can be leavened.

Laminated Pastry Laminated pastry dough is made by folding a piece of pastry onto itself many times. In between each layer is a thin slathering of butter. This creates a multi-layered and flaky finished dough. Unleavened examples of this kind of dough are puff pastry and phyllo dough. A leavened version is a croissant.

Non-laminated Pastry these pastries have dough that has not been folded onto itself many times. Unleavened versions of these types of dough include choux and pie dough. A leavened version is brioche. With all these types of dough, is there one dough to rule them all? That's

entirely up to you. With all this dough diversity, there is something for every taste and preference.

4.2 Chilling of dough

Speed of chilling with precise temperature control is important in the baking industry. For many years, carbon dioxide (CO2) chilling has proven to be an integral step in a variety of applications. In dough and batter preparation, CO2 snow will maintain the constancy of ingredients like butter or shortening by eliminating smearing and retaining plasticity. CO2 snow chilling also prevents melting of ingredients like candy pieces. The liquid nitrogen cooling delivers nearly the same controlled temperature profile as that achieved with carbon dioxide.

Typical desired temperatures of dough might range from 80ºF (27ºC) down to 40ºF (4ºC), depending on the product being mixed. If dough temperatures are not controlled, the texture and consistency of the dough will be adversely affected, which will in turn affect the way the dough behaves during later processing. In the limited time available for temperature control under ideal mixing conditions, the cooling system must offset heat from three major sources:

- Friction created when the dough is kneaded.
- The hydration that takes place when the dry ingredients absorb water.
- The temperatures of incoming ingredients, especially the flour, which during the summer months and in generally hot climates may reach well above 100ºF (38ºC) in silos.

Dough resting and dough cooling improve its processing properties. For example, cooled laminated doughs do not shrink or shrivel up so much. The individual layers become stabilized when puff pastry, for example, is not subjected to immediate further processing, but instead a corresponding dough resting time is adhered to. This ensures that the baked product has a larger, more uniform volume. Dough cooling and/or resting sections can be integrated into the production operation, depending on the product and customer's requirement. Different times (from approx. 30 minutes to around four hours) can be implement in this respect. However, experts say the average is one to two hours.

Uniform blending and optimum mixing of ingredients are essential to creating repeatable batch-to-batch dough quality. It is not just the quality of the dough that is affected, however; the productivity of a baking operation also depends on having the dough achieve the ideal formulated texture and handling characteristics.

The dough temperature during and after mixing affects all these factors. Warm dough may stick during dividing, rounding, and molding. It may not proof up as anticipated, or it may over-bake or under-bake in the ovens. The net result can be low-quality dough, wasted product, and reduced plant output. The dough is folded over the butter and then carefully rolled out again. This process is called a turn. The dough is carefully wrapped up and refrigerated or frozen briefly to firm up the butter again before it is rolled out and folded again. The more turns completed, the more layers of butter and dough are formed. The more layers formed, the flakier the finished product. But there is a delicate balance of doing enough turns to produce flakiness, but not so many turns that the butter ends up completely incorporated into the dough.

4.1.1 Principle of dough chilling/cooling

The cooling machine consist cell cooling plates with fixed pipework. The plates are modularly integrated into the cooling tunnel's conveyor belt system. The conveyor belt with the dough being cooled rests on stainless steel plates which are said to be wear-free. The cooling cell has several levels. Between each level there are collection trays with a central drainage system. A run-off system ensures that water used for wet cleaning can drain away as required. The trays can also be removed for cleaning. In the Fritsch cooling system with contact cooling, the customer's own coolant fluid circulation can be used to regulate the closed cooling system's temperature. The temperature of each conveyor belt level can be regulated individually.

4.1.2 The advantages of contact cooling

- The entire dough sheet cools down quickly and gently to the required core temperature, thus increasing resting times at the target temperature
- Dough development control (yeast) through fast, con-trolled cooling
- Stepwise cooling through individual temperature settings for each conveyor belt level

- Indirect air movement minimizes dough sheet skinning and drying out
- No cleaning and maintenance effort on the components installed in the dough area, and no infestation by bacteria or spores (closed liquid cooling system)

Figure.5 Dough cooling system

4.3 Filling of dough

Is required to minimise pastry shrinkage and give the pastry time to hold its new shape. The stronger the flour the longer the rest time, although this can be decreased with the use of reducing agents although these can affect the end quality of the dough. The pastry is stored covered overnight in a retarder or chiller. In the morning the pastry must be left to warm up to processing temperature before a final sheeting and production of pies begins.

Short pastry is commonly used with sweet fillings, such as fruit. The filling needs to be of the correct consistency to avoid boiling out during baking and excessive moisture migration in the finished product

Self-check 4	Written test

Name…… ID…… Date…….

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

True or false

1. Dough filling is required to maximize pastry shrinkage and give the pastry time to hold its new shape.
2. Speed of chilling with precise temperature control is not important in the baking industry

Short answer

1. write three major sources that cooling system must offset heat
2. write the advantages of contact cooling

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

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

Information Sheet 5- Identifying, removing or rectifying and/or reporting unacceptable scaled and molded dough

5.1 Introduction

During final moulding the shape of the dough change. After mixing the dough goes through a number of processing stages, these change the shape of the dough and re-orientate the bubbles. From dividing the dough piece generally passes through a 'rounding' stage such as a conical 10 moulder. It later moves to a sheeting stage, passes under a curling chain, then the pressure board and guide bars may well determine the length of the dough piece coming from the end of the final moulder.

5.2 Unacceptable dough structure

Faults in loaf scrap structure, such as dis colored, coarse patches, streaks and variation in softness are not uncommon in modern cereal dough making. Many combinations of raw materials and dough processing stages can influence the occurrence of such faults but they have a common origin. They are the direct result of instability in the structure formed during mixing and/or subsequent damage to the bubble structure during moulding. It is important to remember that dough is more likely to be damaged during final moulding if the dough bubble structure is vulnerable in the first place.

Areas that certainly need to be investigated if dough stability are:

- Flour protein levels and quality of flour.
- Grade colour (bran contamination)
- Oxidation

During the mixing of a dough, oxidation causes bonds to form which increase the strength of the gluten. Too much mixing or kneading (really only possible with a mixer) can lead to over oxidation, causing the flour to become bleached and the finished loaf to lose flavour.

- Fat failure
- Tight doughs
- Cold doughs.

All of the above can influence how stable the dough is during processing and how much pressure is required to change the shape of the dough at the final moulder stage.

Dough sheets formed during final moulding were sampled and their density and rheological properties measured. Evidence of loss of bubble structure and changed rheological properties were found to coincide with the damage patterns identified using the coloured dough. As a result of these studies it is now possible to trace areas of damage back to where they occurred during final moulding. We have also found that the problems are affected by the direction of dough feed into the dough moulders.

When gluten has been adequately developed for bread dough, the dough will take on several characteristics. Some bakers rely on the “window pane test” to ensure that dough is kneaded properly, in which you can stretch the dough thin enough that you can see through it. A well kneaded dough will be stretchy, elastic, and bounce back when poked.

Overworked dough can happen when using a stand mixer. Dough will feel “tight” and tough, as the gluten molecules have become damaged, meaning that it won’t stretch, only break, when you try to pull or roll it. Underworked dough on the other hand, won’t form a ball shape easily. As gluten molecules haven’t developed yet, the dough flops and also tears. It hasn’t come together yet, and requires more kneading. Over kneaded dough can’t be fixed and will result in a rock-hard loaf.

Self-check 5	Written test

Name…… ID…… Date…….

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

Choose

1. Areas that certainly need to be investigated if dough stability are:
   A. Oxidation
   B. Grade colour (bran contamination)
   C. Flour protein levels
   D. All

2. A well kneaded dough will be
   A. Not stretchy
   B. Not elastic
   C. Bounce back when poked
   D. None of the above

3. Which one of the following factors can influence the dough stability during processing?
   A. Fat failure
   B. Tight doughs
   C. Cold doughs
   D. All

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

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

Operation Sheet 1-Techniques of weighting ingredients

Ingredients	material
Scale	Water
Flour	Knife
Yeast	Plastic bag
Fat/butter	Blade for molding

Method

1. Turn the scale on
2. Choose your standard of measure (grams = gr) or (ounces = oz)
3. Place your chosen container such as a mixing bowl on top of the scale. You will see that the scale will register and display the weight of the bowl
4. Press the zero or tare button on your scale to remove the weight of the bowl and bring the display back to zero. Basically you are telling the scale to ignore the bowl and only measure what goes into the bowl.
5. Start adding your first ingredients such as flour until your display shows the correct amount has been added. You can easily subtract ingredients if you add too much.
6. Press the tare or zero button to bring the display back to zero
7. Measure your next ingredient and continue this way with the rest of the recipe (you can also switch back and forth between grams and ounces if needed)

Operation Sheet 2-Techniques of manual dough kneading

Step 1. Pull the upper edge of the dough toward you.

Step 2. Push it away with the heel of your hand.

Step 3 Rotate the dough a quarter turn (90 degrees) and repeat.

Step 4.Do this 10 to 12 times, until the rough mass takes on a smoother, stronger feel.

Operation Sheet 3- Dough dividing techniques

Step 1. Add the flour on the bench / counter

Step 2. Put a plastic bag on the scale, and flour it

Step 3. Ease the blob of dough out of the bucket or bowl in which it has been bulk proofing.

Step 4. Flour the top of the blob of dough, just a bit

Step 5. Turn on the scale

Step 6. Use knife, hack off a lump of dough and plop it on the scale.

Step 7. Transfer that blob to a floured part of the bench, and repeat

Step 8. Pat each lump into a flattish rectangle and letter fold it gently, let them rest for 15 minutes and then shape

Operation Sheet 4-Techniques of dough laminating

Step 1. Make and roll out a lean dough, meaning a dough with little to no fat.

Step 2. Place a flattened piece of cool elastic butter on top of the dough

Step 3. Fold the dough over the butter and then carefully rolled out again.

Step 4. Wrap up the dough carefully and refrigerate.

Operation Sheet 5- Techniques of dough molding to initial shape

Step 1. Make dust the top of the dough with flour and divide it into pieces scaled to your desired dough weight.

Step 2. Push the blade against the dough, and as you push, turn it slightly down across your work surface. Both of your hands work in unity: your empty hand tucks the dough under as you push the blade into the dough. The motion is quick and gentle.

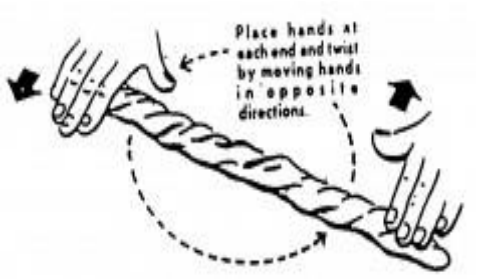
Step 3. Repeat this motion with your blade and hand over and over, gently rotating the dough each time. You'll notice with each pass that the dough tightens more as it snags the dry work surface.

Step 4. Continue with these motions until the dough is in a loose, round shape. There should be no visible seams or bulging sides. If there are, continue to gently round the dough and smooth the surface.

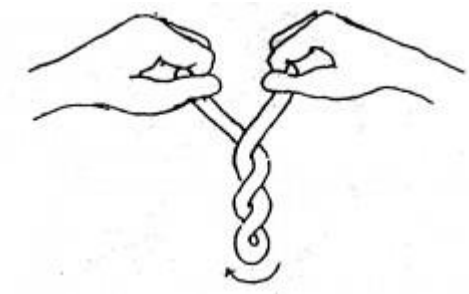
Step 5. Let them rest on the bench before shaping.

Operation Sheet 6- Technique of molding dough to final shape

1. Use one piece of dough. (2 ounces)
2. Form a rope of dough about 12 inches long. Place your hands at each end and twist by moving your hands in the opposite directions until the rope is about 14-16



3. Pick up the twisted rope holding the ends. It should automatically twist together. Pinch the ends together to seal.



4. Place on parchment-lined or lightly-greased baking sheet.
5. If desired, lightly mist breadsticks with water and sprinkle on sesame seeds, poppy seeds, Italian seasoning, grated Parmesan cheese or brush with egg wash.
6. Cover and let rise until breadsticks are almost double in size.

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 **4** hour. The project is expected from each student to do it.

Task-1 Perform weighting ingredient

Task-2 Perform manual dough kneading

Task-3 Perform dough dividing

Task-4 Perform technique of molding dough to initial shape

Task-5 Perform techniques of dough laminating

Task-6 Perform technique of molding dough to final shape

LG 17	LO 2- Mould dough and divide to meet product requirements

Instruction sheet

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

- Molding dough to final shape
- Placing dough in tins or on baking surfaces
- Production specifications of dough
- Applying proving process
- Identifying, removing or rectifying and/or reporting unacceptable final proved dough

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:

- Mold dough to final shape
- Place dough in tins or on baking surfaces
- Production specifications of dough
- Apply proving process
- Identify, remove or rectify and/or report unacceptable final proved dough

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- Molding dough to final shape

1.1 Introduction

The final shape is done once the dough is rested. Creating some surface tension is important and is vital to the dough retaining is shape and achieving good oven spring, however be careful as over-tightening will also prevent a good rise.

1.2 Final moulder

The thin, flat dough pieces taken from the sheeter are moulded or formed into tight, uniform cylinders of the proper shape and length. The final moulder is, essentially, a forming conveyor which is equipped with 3 parts that define the product's final dimensions. As the dough piece exits the bottom head roller, it comes in contact with the curling chain. This causes the leading edge to slow down and begin curling back on itself. The weight of the curling chain begins the curling of the dough. Its length can be adjusted as needed. When the dough piece exits the curling chain, it is completely rolled-up.

Pressure board and side guide bars

These parts give the dough piece its final loaf-type or cylinder shape by exerting downward/outward pressure and forcing the dough against side bars. This further de-gasses the dough pieces to form tight, uniform and sealed cylinders.

1.3 Final shaping techniques

- Shaping into a round

Using the same technique that was used previously in pre shaping. The dough should feel strong and elastic making it easier this time.

- Shaping into a long

This shape is probably the second most common as it used for tin and bloomer style breads.

- Shaping bread rolls

Shaping bread rolls is an excellent way to get a feel for the dough. The ideal technique starts with a flat hand and ends in a high curve shape though the stickiness of the dough will often dictate otherwise.

- Shaping into a crown

- A split bread (Fendu)
- A four-braid plait
- Shaping a cottage loaf

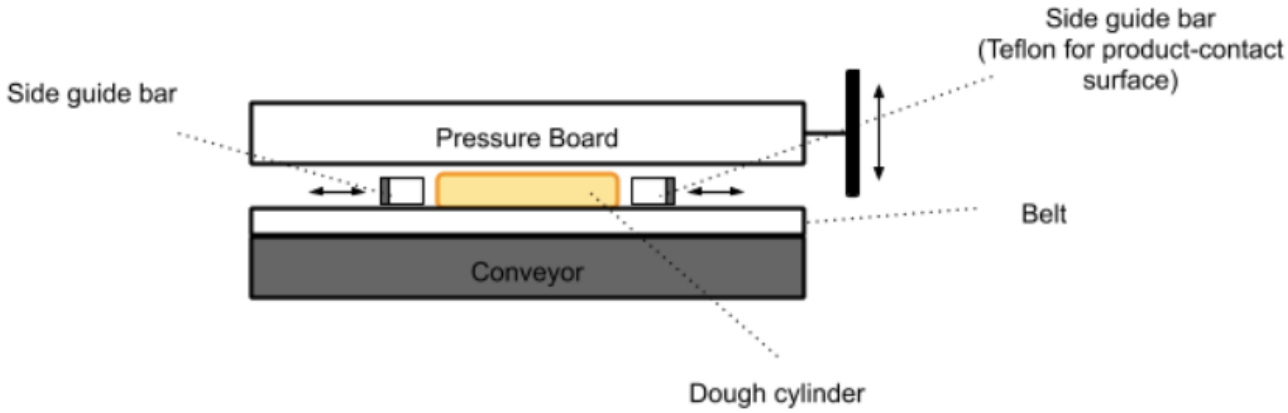


Figure 6. Final dough molding

1.4 Manual techniques to make final shaping of dough

The actual shaping is your last chance at touching the dough. In firm and decisive moves, mold the bread into the shape you are after. The goal is to build a shape that can keep its form as it rises and has good surface tension — this will help it expand and open beautifully when baked in the oven. Don't touch the dough more than you need to, but don't be afraid of the dough either: I find that most beginning bakers are rather too gentle than too forceful with their doughs. The best way to learn shaping is by practice, and then some more practice.

Self-check 1	Written test

Name…… ID…… Date…….

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

Short answer

1. Final shaping techniques of dough
2. What is Pressure board and side guide bars

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

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

2.1. Placing dough in tins

Well proofed and moulded dough are placed in tinned steel bake ware that made from sheets of steel that have been covered with a thin coat of tin, making it a good conductor of heat. The tin coating allows the bake ware to heat slowly and evenly. Tinned steel bake ware will darken after extended use, which may have an effect on baking times.

Fig 7 .Tinned steel

After proving, the dough is put in the oven for baking. The important factors during this period are:

- The oven temperature
- The use of steam when putting the dough in the oven
- The type of oven
- The baking time

The oven temperature must be between 200°C and 240°C. When the temperature is below 200°C, the product does not develop sufficiently and the requisite baking time increases. When the temperature exceeds 240°C, the product browns on the outside whilst the inside is underdone.

Dough Transfer Systems - There are many methods used to transfer dough from one point to another. Briefly they are:

- Cutting the dough in large pieces by hand and transferring it from the dough trough to the baking machine or to the oven.
- By locating the mixer on the second floor, the dough is dumped from the dough trough through a hole in the floor into the baking oven.
- Dough Trough Hoists have been designed to lift dough troughs filled with fermented sponges to be returned to the mixer to be mixed into dough. They are also designed to lift remixed doughs to be dumped into the divider hopper.
- Other methods available are, Conveyor Transfer Systems, Dough Pumps, and Rotary Dough Feeders. Some dough's such as Frozen Dough, Bread Dough and Stiff Dough are not suitable to be transferred by the Dough Pump. One reason why it is not suitable for some types of dough is because it creates heat during the transfer process.

Fig 8.Pump feeder

Fig 8b. Rotary feeder

Fig 8. C Belt conveyor

Fig 8. Placing dough in baking surface

2.2. Dough conveying systems

Dough conveying systems fills the gap between the mixer and the dough dividing equipment. It is a smooth-handling system that moves dough from one stage to another in an efficient and productive way. Often connecting mixers and dividers, this type of conveying equipment is commonly used in continuous mode production environments. It requires a high level of automation and is usually found in large-scale production bakeries such as white pan bread production plants. Discrete or single pieces of specially shaped dough, can only be moved by band or belt conveyors. Conceptually speaking, dough conveyors are the “bridge” of the production line.

The following is a good example of a straight dough concept:
Horizontal mixer →* Divider → Rounder → Intermediate Proofer → Sheeter/Moulder → Panner → Proofer → Splitter
The arrow symbol (→) represents dough conveying systems.

Since the oven turns raw dough into bread by baking, we cannot use the term “dough conveying” system after this step. In a high-speed bakery plant, dough conveying systems are fully mechanized and are usually connected to the supervisory control and data acquisition system (SCADA). These conveyors are then centrally supervised and controlled electronically. In some cases, dough conveying systems are used occasionally or temporarily (e.g., in production peaks), and hence may not require permanent connection to the line. However, they may still need to be set manually, e.g., belt speed.

Self-check 2	Written test

Name…… ID…… Date…….

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

Short answer

1. Write method of dough transferring
2. List The important factors during placing dough on baking surface

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

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

Information Sheet 3- Production specifications of dough

3.1. Introduction

The proportion of water to flour is the most important measurement in a bread recipe, as it affects texture and crumb the most. Professional bakers use a system of percentages known as baker's percentage in their recipe formulations. They measure ingredients by weight instead of by volume, because measurement by weight is much more accurate and consistent than measurement by volume, especially for the dry ingredients.

The amount of flour is always stated as 100%, and the amounts of the rest of the ingredients are expressed as a percent of that amount by weight. Common table bread in the U.S. uses about 50% or more of water, resulting in a finely textured, and light bread. In yeast breads, the higher water percentages result in more CO_2 bubbles and a coarser bread crumb. One pound (450 g) of flour will yield a standard loaf of bread or two loaves.

At the bakery, frequent complaints such as “the dough is too tough” or “the dough has too much pan flow” or “let’s decrease water, the dough is too sticky” are often discussed. Bakers always aim to produce the best dough possible for the makeup stage. A big portion of the credit for baking high-quality bread goes to the handling properties of dough.

It is important to understand what the handling properties of dough mean, how they are affected and how they affect the finished products.

There are four major dough control properties:

- Extensibility
- Elasticity
- Resistance to deformation (tenacity)
- Stickiness

Extensibility: Ability of the dough to be stretched extended or elongated when forces, stress and pressures are applied to it. A certain amount of extensibility is necessary for dough to be

moulded into different shapes. An extensible dough has the ability to stretch (expand) as the gas pressure from yeast fermentation builds up.

Elasticity: Ability of the dough to regain its original shape after a deforming force has been applied and removed. Simply put, it is the ability of a dough to spring back when it is stretched.

Resistance to deformation (tenacity): Ability of the dough to resist deformation when being stretched. A dough with too much tenacity is difficult to work with during makeup. Laminated doughs that are too tenacious are often difficult to roll out.

Stickiness: Ability of the dough to stick to the surfaces which they come into contact with. Dough needs to have minimum stickiness to be properly shaped and conveyed during makeup stages. In most cases, dough stickiness is the least desired property given the operational and cleaning issues that a bakery has to deal with. The simplest way of modifying the stickiness of dough is by increasing or decreasing water absorption.

3.1. Optimizing dough properties

In general, dough should have good extensibility and just enough elasticity to retain gasses yet expand sufficiently during proofing and baking (oven spring) while retaining its original or desired form.

Similarly, a dough should have as little resistance to deformation as possible to allow for a proper moulding while preserving the “delicate” cell structure.

The balance between elasticity and extensibility may of course change depending on the product and dough needed. For example, hearth breads require good extensibility and good elasticity otherwise the loaves could flatten out rather than bake up high and round.

Aspects that influence dough handling properties

- Wheat class used at the mill (% extraction)
- Hydration (water absorption)
- Percentage of functional polymers (i.e. arabinoxylans, gluten-forming proteins, damaged starch)

- Quality of gluten-forming proteins (gliadins and glutenins)
- Presence of bran particles (exerting a cutting or disrupting action on the gluten matrix)
- Presence of some non-wheat cereal flours
- Mixing conditions (rpm, work input, mix time)
- Over mixing/under mixing
- Degree gluten development
- Dough temperature
- Presence of water-competing ingredients (e.g. sugars, salt, egg proteins) that limit the hydration of functional polymers
- Addition of functional ingredients, such as oxidizing and reducing agents
- Length of dough resting period

Characteristics of a dough that is too extensible, with very low elasticity and poor resistance to deformation. If dough is too elastic, with very low extensibility and too much resistance to deformation, it will exhibit the following characteristics during processing:

Dough mixing: possible under mixing (dough too stiff, tight and/or tough), insufficient water absorption.

Dough pump: excessive friction against equipment surfaces causes excessive heat which increases dough temperature beyond allowable limits (promoting excessive gas production).

Dough divider: Bucky or gassy dough could cause considerable scaling weight variations.

Dough sheeting and moulding: poor machining as moulder and Sheeter settings (pressures) must be increased (tightened) to form the final dough shape leading to cell structure damage, excessive 'spring-back' after application of stress, poor pan flow.

As a result, the finished product will have too round of corners, wild break and shred, and poor symmetry, volume and diameter In dough making process, it is necessary to conduct the correct final specification of dough like:

- Elasticity
- Stability
- Color
- temperature

Controlling dough temperature during mixing until final development is critical for a consistent fermentation process .The less variation in the final mixed dough; the simpler it is on the downstream process.

To maintain consistency in dough temperature, many mixer manufacturers incorporate cooling features into their equipment design. For instance, individual cooling set-points on its horizontal mixers that is customizable by recipe and also takes environmental factors into consideration. Various temperature control modes (by timer versus by set-point) allow better control independent of changing environment conditions, noting improved repeatability over manual settings in adjusting for conditions such as summer or winter.

Temperature control can happen through a refrigerated jacket on the bowl or a refrigerated agitator bar, such as with horizontal mixers from Shaffer, a Bundy Baking Solution. It's a reason a bread manufacturer would want to consider a horizontal mixer for artisan production that consistent, cooler dough temperature. Shaffer offers a refrigerated agitator as a key component of its horizontal mixers. For us, it's all about adding that refrigerated system that cools the bar in the triple roller-bar agitator." The system, he said, can reduce dough temperature from 4 to 6 F°.

3.2. The Manufacturing Process

3.2.1 Mixing the dough

Premeasured amounts of flour, salt, water, and yeast are blended in commercial mixers in several hundred pound batches. Some bakeries may add a mold retardant. After a second proofing, the circle-shaped dough is baked quickly at a very high temperature so that the upper and lower crusts separate, forming a pocket. Such as calcium propionate. Large motorized arms in the mixer knead the dough to the desired elasticity.

3.2.2 Extruding the dough

The dough is scooped out of the mixing bowl and fed into an extruder that forms the dough into tennis-ball sized portions. Each ball is then dropped into cups moving on a conveyor belt.

3.2.3 First proofing

The dough balls are allowed to rest and rise in the cups for approximately 15 minutes. This process is called proofing. In some processing plants, the dough is allowed to proof in one continuous layer before it is cut into individual portions.

3.2.4 Cutting and forming the pitas

The dough balls are turned out onto a sheeter that travels on a linear conveyer belt. The sheeter passes under a series of rollers that press the dough into the desired sized circles. If the dough is still in one layer, the rollers press it to a thickness of about 0.125 in (0.3175 cm). The flattened dough is then passed under die-cuts that create circular pieces. The excess dough, about 10%, is recycled back into the extruder.

3.2.5 Second proofing

The circular loaves move into the top shelf of a rotating proofer. As they slowly move down to the bottom of the proofer, the rises again. They exit the proofer and are conveyed into the oven.

Self-check 3	Written test

Name…… ID…… Date…….

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

Matching

PART A	**PART B**
1. Extensibility	A. Ability of the dough to be stretched extended
2. Elasticity	B. Ability of the dough to regain its original shape
3. Tenacity	C. Ability of the dough to resist deformation when being stretched.
4. Stickiness	D. Ability of the dough to stick to the surfaces which they come into contact with

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

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

4.1 Introduction

Proofing (also called proving) is a step in the preparation of yeast bread and other baked goods where the dough is allowed to rest and rise a final time before baking. During this rest period, yeast ferments the dough and produces gases, thereby leavening the dough.

In contrast, proofing or blooming yeast (as opposed to proofing the dough) may refer to the process of first suspending yeast in warm water, a necessary hydration step when baking with active dry yeast. Proofing can also refer to the process of testing the viability of dry yeast by suspending it in warm water with carbohydrates. If the yeast is still alive, it will feed on the sugar and produce a visible layer of foam on the surface of the water mixture.

Just like baking, proofing is a thermal unit operation in the bakery. During proofing, the dough absorbs heat from the humid, warm surroundings to reach a target internal temperature.
Bubble growth during proving is influenced by four factors:

- The rate of carbon dioxide production by yeast
- The extent to which the carbon dioxide is retained within the dough piece;
- The rate of carbon dioxide diffusion from the (saturated) liquid phase into the nitrogen
- The rate of bubble coalescence.

4.2 Supplying dough to the prover for production

Reliable and hygienic intermediate provers and conveyor systems with flexible specifications to suit a variety of applications. Dedicated provers are available to rest the dough before moulding. Alternatively, special purpose flour-free resting systems can be designed to transport the dough pieces from the upstream forming equipment while allowing the dough pieces to rest.

4.2.1 First Prover

The First Prover accepts dough pieces from the Conical Rounder and relaxes them prior to final moulding. Removing stress from the dough ensures that it can be moulded without tearing and will prove and bake evenly. Using a First Prover enables the resting to be carried

out in a controlled, hygienic environment that preserves the rounded shape and provides a well-controlled feed to the moulders. The unit is compact, hygienic and easy to maintain from floor level

4.2.2 Final Proof

The final proof is a continuation of yeast fermentation, which allows the molded dough piece to relax and expand. A dough piece that has gone through the sheeting and molding process is degassed and lacks volume.

Final proofing produces an aerated dough with optimum shape and volume when baked. Proofing happens in a controlled atmosphere with warm and humid conditions. Proofing temperature is generally higher than fermentation temperature, at around 32–54℃ (90–130℉).

The final prove can be done at room temperature until the dough has almost doubled in size. This can take up to a few hours depending on the quantity of starter added. This process can be slowed down by placing the dough in the fridge. An overnight prove in the fridge also firms up the surface of the dough making it easier to score and hold its shape before you get it in the oven. Dough proved in the fridge may not appear to have risen as much as dough proved at room temperature. Longer prove times are one thing that can contribute in a big way to having a more pronounced the ‘sour’ flavor.

During final proofing, starch is converted into sugars via enzyme action. The sugars feed the yeast, and the yeast utilizes the carbohydrates in the absence of oxygen to produce carbon dioxide and alcohol. The carbon dioxide is retained in the cells formed in the protein matrix, causing the cells to grow and the dough to expand.

4.3 Factors that influence proofing of dough

Three basic factors are important in the final proof:

- Temperature – A range of 35–37°C (95–100°F) is recommended. Temperature and time factors work closely together
- Humidity – relative humidity of 85–95%.

- Time – Proofing time should be 60–65 minutes. Over proofing results in loaves with pale crust color, coarse grain, poor texture, and a flavor with acid overtones.

Fig 10 dough proofer

Table 2 Effects of temperature during proofing

Too high	Too low
• Yeast works too fast on fermentable sugars, producing excessive amounts of CO2, causing open cell structure and excessive volume in the finished product. • Dough rises too quickly. • Proof time is drastically reduced, affecting overall operations scheduling. • Insufficient production of flavors and aromas that are necessary for optimum product quality. • High risk of over proofing, if not properly balanced with a reduced proof time.	• Yeast works too slowly and produces insufficient gas, causing poor volume and dense crumb grain. • Dough rises too slowly. • Proof time is drastically increased, affecting overall operations scheduling. • High risk of under proofing if not properly balanced with longer proof times.

Table 3: Effects of relative humidity (RH) during proofing

Too high (too moist conditions)	Too low (dry conditions)

• Product sticks in the pan • Small blisters on the crust • Increased pan flow • Proof time needs to be reduced • White spots • Flat bottom in hearth products • Poor volume	• Capping is highly probable • Rounded top • Rough crust color • Proof time needs to be increased

Commercial bakeries have specialized enclosures for the final proof. These enclosures are well insulated and able to maintain interior temperature and humidity. Movement of loaded racks into and out of the proof box can be automated or manual. Some systems are fully automated, loading molded dough through an opening in the proof box on a conveyer system. Proofers may have conveyors in a straight line or arranged in spirals for a continuous proof-and-bake system.

4.4 Importance of the final proof

Yeasted doughs need to undergo a final proof after shaping to regain volume and extensibility before being baked. During final proofing, acids are formed through yeast activity and contribute to flavor development. Adequate proof time is needed; otherwise, the dough pieces are unable to relax sufficiently, which can result in poor volume and a dense texture.

Final proofing time varies based on different types of doughs.

- For short mix doughs, final proofing time is short, up to 1 hour.
- For improved and intensive doughs mixing, final proofing time takes between 1 and 2 hours.
- For bread leavened only by a sourdough starter, proofing times are even longer.

4.5 Characteristics of proved dough

The dough will change considerably during the bulk fermentation period (by bulk fermentation, we mean the first rise or proofing time), and knowing what to look for will help you determine if it is ready for shaping or not. Here are 4 signals to look for that will tell you if your dough is ready:

4.5.1 Density

When the dough is at the initial stages, it will be dense. During the bulk fermentation, the gluten structure will begin to develop, which helps to trap air into the dough. As air bubbles start to develop, the dough will not only grow in size, but also become lighter and fluffier. It will lose its density and become more airy.

4.5.2 Size and shape

When you handle the dough after its bulk fermentation, it will feel quite different to when you first handled it. The dough will now be very light and have a ‘bouncy’ kind of a feel to it. In fact, if you give the bowl/container some gentle movement backwards and forwards, the dough will ‘jiggle’ and be wobbly. This is the point at which it is done and ready to shape.

Fig 9 .a) unproved dough

Fig 9.b) Proofed dough

4.5.3 Appearances

A dough that has been proofed properly will still have ‘strength’ to it when handled. It will feel alive by being a little stubborn in the shape it wants to be. You will find that it has developed stretchiness and elasticity.

Whereas before the proofing, the dough would have been quite flat and easy to manipulate (rather like play dough), once the dough has proofed enough, the dough will be more elastic and resist being overly stretched. Once the dough has proven for enough time, it will look different and shows the following signs:

- Grown in size

- Bubbles in the dough – These can be seen just beneath the surface or along the sides of the bowl.
- Smooth surface – there should be no shagginess in the texture of the dough, it should smooth and almost shiny at its surface.
- A rounded surface – the top of the dough should looked domed, indicating it is still growing and has strength left in it. If it becomes flat or collapses, this is a sign it has over fermented.

Self-check 4	Written test

Name…… ID…… Date…….

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

True or false

1. During final proofing, acids are not formed through yeast activity and contribute to flavor development
2. Growing in size of dough shows the dough are proven for enough time
3. When the dough is at the initial stages, it will not be dense

Short answer

1. List factors that influence final dough proofing
2. Describe effects of humidity on dough proofing
3. Describe effects of temperature on dough proofing

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

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

Information Sheet 5- Identifying, removing or rectifying and/or reporting unacceptable final proved dough

5.1 Over proofed dough

The key to a light and airy bread is the CO_2 gas development that takes place during the fermentation process. However, excess gas will create too many air bubbles that can't hold up once in the oven. As a result, the dough falls. Over proofed dough does not expand much in the oven which results in a dense and deflated bread. As the gluten network weakens and large amounts of gas are produced, the dough collapses.

During pop up an over-risen loaf into the oven, it will have no capacity to further expand in the oven and will thus deflate. The crust will appear wrinkled. But this doesn't mean that the bread will taste bad, however. The shape and texture will be different and the loaf won't look very appealing, but the bread is still edible. One of the major signs of over proofed dough is the smell like alcohol (many people said the smells resembles beer), then you have probably over proofed it. The reason why the dough smells a bit funny is the yeast that is converting sugars into carbon dioxide and alcohol. Usually, sweeter breads such as brioche tend to over ferment as they contain greater amounts of sugar and yeast.

5.2 Under proofed dough

There are some common signs to look for in dough that will indicate it's under-proofed and needs more time to ferment.

Little volume. If dough hasn't grown by 20-50% than chances then dough is under-proofed. There are different reason that dough Loaf became too small

- Dough too stiff because too much flour during mixing or kneading; dough should be tacky after mixing, smooth after kneading
- Too much salt
- Not enough yeast or starter
- Bread rose at too cool a dough mixture to allow yeast development
- Too short a rise
- Dough not kneaded after the last rise and before forming the loaf

- Oven temperature was too high.

Lack of gas bubbles. Bubbles are a good indication that gases are being trapped.

Deflation. Dough drying out and forming a crust during rising; Grease surface and cover dough with plastic wrap when rising.

Poorly formed loaf, allowing oven heat to cause instant aeration when put in the oven.

Over-risen dough, Too stiff dough, Insufficient rising time are sign of deflation

5.3 Under fermented dough

Under fermented dough results in a not very tasty and appealing bread. In order to get the perfect dough, it must have enough time and a warm environment to rise.

To check whether the dough is under fermented, it's necessary to perform the poking test again. Mean that by pressing finger into the dough for about 2 seconds. If the dough springs back completely and there is no indentation left, it is under proofed

Self-check 5	Written test

Name…… ID…… Date…….

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

Choose

Which one of the following is not sign of under proved dough?

A. Little volume
B. Lack of gas bubbles
C. Deflation.
D. big volume

One of the following represents reason that dough loaf became too small

A. Too much salt
B. Enough yeast or starter
C. Too long a rise
D. Oven temperature was too low

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

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

Operation Sheet - 6 Techniques of manual identification of Unacceptable dough

Step 1: Perform the fingertip test to make sure your dough is over proofed**.**

Step 2: Remove the dough from the basket or other vessel in which you're proofing it.

Step 3: Degas the dough by pressing down firmly on it. The pressure applied is the same as when you shape the dough.

Step 4: Shape the dough, and return it to the basket or other vessel for proofing.

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 **1** hour. The project is expected from each student to do it.

Task 1- Preform Techniques of manual identification of unacceptable dough

LG 18	LO 3- Clean equipment

Instruction sheet
This learning guide is developed to provide you the necessary information regarding the following content coverage and topics: • OHS hazards and controls • Cleaning equipment • Disposing waste with workplace policies and procedures • Conducting work with workplace information • Environmental guidelines and legislative 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: • OHS hazards and controls • Clean equipment • Dispose waste with workplace policies and procedures • Conduct work with workplace information • Environmental guidelines and legislative requirements
Learning Instructions:
1. Read the specific objectives of this Learning Guide. 2. Follow the instructions described below. 3. Read the information written in the information Sheets 4. Accomplish the Self-checks 5. Perform Operation Sheets 6. Do the “LAP test”

Information Sheet 1- OHS hazards and controls

1.1 Introduction

There are many definitions for hazard but the most common definition when talking about workplace health and safety is “A hazard is any source of potential damage, harm or adverse health effects on something or someone.” The CSA Z1002 Standard "Occupational health and safety - Hazard identification and elimination and risk assessment and control" uses the following terms:

- Harm – physical injury or damage to health.
- Hazard – a potential source of harm to a worker.

Basically, a hazard is the potential for harm or an adverse effect (for example, to people as health effects, to organizations as property or equipment losses, or to the environment).

1.2 Types of OHS in cereal bakery

1.2.1 Accident hazards

- Cuts and punctures, esp. while working with sharp tools
- Falls of workers because of incorrect use of ladders, wet and slippery floors and unguarded scaffolds
- Falls of bags of flour and sugar during transportation.
- Danger of falls while carrying heavy loads.
- Mechanical and electrical injuries during work with conveyors, mechanized equipment used for mixing ingredients to make dough, and baking processes.
- Defective electrical equipment and installations, esp. hand-held tools which may cause electric shock.
- Extensive use of liquid and/or gaseous fuels for baking creates increased fire and explosion hazard
- Dry flour presents a constant hazard of fire and dust explosion (cigarette lighting in such an environment may be extremely hazardous)

1.2.2 Physical hazards

- The high temperatures and the high levels of relative humidity may cause fatigue and thermal exhaustion in bakers

- Exposure to infrared radiation; cataracts may be produced by prolonged exposure

1.2.3 Chemical hazards

- Exposure to flour: may cause respiratory system disorders and skin diseases
- Exposure to spices: many bakers working with some spices suffer from chronic conjunctivitis and chronic rhinitis; allergic skin diseases are sometimes found; after prolonged exposure, respiratory infections, particularly chronic bronchitis and sometimes even bronchial asthma, may develop
- Exposure to sugar dust: may cause dental caries
- Exposure to carbon di oxide in mechanized bakeries, dough which is in an active state of fermentation may give off dangerous amounts of carbon dioxide
- Exposure to carbon monoxide, combustion products and fuel vapors: firing equipment which is badly adjusted or has insufficient draw, or defective chimneys, may lead to the accumulation of unburned fuel vapors or gases or of combustion products, including carbon monoxide, which may cause intoxication or asphyxia

1.2.4 Biological hazards

- Exposure to fungi and yeast: hypersensitivity reactions and skin infections may be caused due to fungal antigens inhaled with dusts during the work time; these usually involve pneumonitis with asthmatic symptoms
- Exposure to parasites: vanilla flour and coconut flour may be infested with cereal parasites, which cause lesions and "grain itch"
- Exposure to molds: bakers may suffer from allergic skin conditions caused by molds such as
- Aspergillus glaucus and Penicillium glaucum that develop in stored flour.
- Presence of rodents and insects may result in bites and infectious diseases

1.2.5 Ergonomic, psychosocial and organizational factors

- Continuous repetitive movements, awkward postures (e.g., sitting or standing for long hours), and excessive efforts (esp. during lifting and moving of sacks and heavy loads) may result in cumulative trauma disorders
- Handling of heavy loads may cause acute disorders, esp. back pain and lesions of intervertebral discs

- Exposure to certain spices may cause specific positive or negative sensitivity to their odors, and/or addiction or disaster.
- Regular work at odd hours, especially. in night shifts, may cause psychological stress

1.3 Manual handling hazards and possible controls

1.3.1 Reaching above shoulder height

Many bakeries require workers to carry out manual handling tasks above shoulder height and below knee height where baking trays, flour and other stored items are kept. When reaching for items above shoulder height, the back is arched and the arms act as long levers, making the load difficult to control and significantly increasing the risk of injuries such as falls, sprains or strains.

Heavier items and more frequently used items should be stored between knee and chest height. If this is not practical, workers should be provided with adequate means to retrieve and place items in storage areas without lifting above head/shoulder height.

1.3.2 Bending forward to pick up low level loads

Bending forward to pick up loads from a low level may cause strains, particularly to the lower back. To reduce the risk of injury, review storage systems in the bakery.

1.3.3 Holding load away from trunk

The risk of injury increases, as the load or arms are held further away from the front of the body. This is most evident when workers reach into display cabinets and ovens. Consideration should to be given to size and accessibility. For example, display cabinets are available with a side opening and completely removable doors. Using baskets in chest freezers will minimise the reaching involved. Moving large baking trays and tins is a high-risk task. They may be heavy, bulky and often hot. Where practical, this task should be eliminated by using trolleys or modifying the load by using smaller trays. When removing hot trays from the oven, long gauntlet gloves protect forearms

1.3.4 Handling stock

Many bakeries receive bulk deliveries of goods. Handling bulk deliveries is another high-risk task. Where possible, the deliveries should be placed near where they will be stored. If this is not practical, place the goods where they will not cause a slip, trip or fall hazard.

When placing stock into storage, heavier items and more frequently used items should be stored between knee and chest height. If that is not practical, workers should be provided with a stepladder or safety step to reduce reaching above shoulder height. Consideration should also be given to using bulk storage bins for products such as flour. Stock levels should be managed to ensure there is adequate room to store items in shelving and storage areas.

1.3.5 Movement around workplace

Repetitive movements are associated with occupational overuse injuries. Where possible, repetitive tasks should be limited by having varied tasks, job rotation and frequent cycle breaks. There are many other risk factors associated with overuse injuries, such as constrained and/or awkward postures and forceful movements.

1.3.6 Duration of tasks

Long and unusual working hours may contribute to physical and mental fatigue. Duration of work periods and work rosters organized are two such factors which may be monitored and modified to reduce the risks associated with fatigue. For further information read the Code of practice: Working hours. Time constraints and increasing demands are potential risk factors for manual handling injuries and slips, trips and falls in the workplace. Workers may be pressured to work too quickly or carry/move increased loads to meet demand. Staff numbers and rostering relative to work demands should be monitored and modified accordingly to reduce such risks. Ways of reducing other slip, trip and fall hazards includes:

- A regular cleaning procedure is in place to keep floors clean of spilt water, oil and flour
- Lighting levels are adequate and
- Signs are visible to warn employees and customers of slippery floors.

Frequently breathing in flour dust may lead to occupational asthma. Minimising flour dust in the air can reduce the health risk.

Health problems from baking flour dust includes breathing in flour dust frequently at work can lead to some people developing a health condition known as occupational asthma. This condition can cause long-term or life-long health problems.

Asthma is a condition of the lungs where the airways to the lungs narrow and cause coughing,

chest tightness, wheezing and shortness of breath. The cause is unknown but it often starts or is made worse because of a number of factors in the environment. Occupational asthma develops when a person becomes very sensitive to a specific substance, such as flour dust, which they frequently breathe in at the workplace.

In the baking industry, dust from baking flour is a factor in the environment that may cause occupational asthma in some workers. When baking flour dust is identified as a potential hazard at the workplace, the ways to reduce the potential health risks for workers include:

- Installing and maintaining good ventilation and exhaust systems;
- Training staff in work practices that help to reduce the amount of baking flour dust in the air; and
- Work practices to reduce the amount of flour dust in the air include:
    - ✓ Gently tipping and shaking bags
    - ✓ Sprinkling flour instead of throwing it
    - ✓ Placing ingredients into the flour instead of dropping them;
    - ✓ Rolling flour bags from the bottom when tipping, to avoid having to fold them when disposing.
    - ✓ Starting the mixer on a slow speed until wet and dry ingredients are combined.

Where possible, eliminate or minimise manual handling by using appropriate equipment, such as suitable trolleys. Workers should be made aware of manual handling risk factors and how to use the risk management approach to minimise such risks.

Slips, trips and falls are among the most common hazards in the bakery industry. Most of the injuries occur from falls on the same level and are due to slippery floors and obstructions resulting in fractures, sprains, bruises and cuts.

Slippery floors

In the bakery industry, floors with flour and/or water spills are the greatest cause of slip, trip and fall injuries. There are several simple ways of minimising the risk of slips and falls.
Sinks and troughs should be designed to avoid water dripping onto the floor.

Install non-slip floor surfaces:

- Non-slip tiles - especially in areas easily contaminated by flour and water;
- Floor treatments;
- Non-slip mats; and
- Drainage in wet areas.
-

Cleaning floors - effective scheduling and adequate frequency.

Transporting fluids - where mechanical aids are not practical, fluid should be transported in a suitable container, such as a bucket with sturdy handle and secure lid.

Appropriate footwear - to be used by workers.

Changes in floor levels

There are several simple ways of minimising the risk of trips and falls as a result of changes in floor levels. These include:

Elimination

Although it is not always practical to eliminate a change in floor levels in an existing bakery, as part of a redesign or refit, eliminating this risk factor would be the preferred control option.

Small ramps may be an effective way of graduating the change in floor levels, to reduce the risk. Bright markings and warning signs are examples of how changes in levels may be clearly indicated. The risk of injury becomes much greater when changes in floor levels are combined with changes in surfaces, slippery floors or inadequate lighting and manual handling tasks. This risk can be controlled by ensuring that the lighting is good and the floor levels have non-slip tiles and non-slip mats. These areas should be kept clear of fluids or any obstruction that might cause a person to slip, trip or fall.

There are several simple ways of minimising the risk of trips and falls as a result of obstructions. These include controls by providing appropriate storage design and space:

- Where possible, items and equipment should be stored in appropriate storage areas and not blocking walkways, emergency exits or restricting access to other items; and
- Workflow should be considered when designing the access to storage areas.

Housekeeping

In dough and related bakery manufacturing and work place is necessary to make sure:

- items such as flattened cardboard boxes are not used as floor mats, as they are a slip, trip and fall hazard;
- walkways are kept clear of obstacles, especially during peak work times; and
- Waste/rubbish is removed regularly from work areas.

In work place the workers be aware of the following to Reducing other slip, trip and fall hazards

- a regular cleaning procedure is in place to keep floors clean of spilt water, oil and flour;
- lighting levels are adequate; and
- Signs are visible to warn employees and customers of slippery floors.

Breathing in flour dust frequently at work can lead to some people developing a health condition known as occupational asthma. This condition can cause long-term or life-long health problems. Asthma is a condition of the lungs where the airways to the lungs narrow and cause coughing, chest tightness, wheezing and shortness of breath. The cause is unknown but it often starts or is made worse because of a number of factors in the environment.

Ways to reduce the risks of occupational asthma when baking flour dust is identified as a potential hazard at the workplace, the ways to reduce the potential health risks for workers include:

- Installing and maintaining good ventilation and exhaust systems;
- Training staff in work practices that help to reduce the amount of baking flour dust in the air; and
- Providing Class P1 disposable masks.

Work practices to reduce the amount of flour dust in the air include:

- Gently tipping and shaking bags
- Sprinkling flour instead of throwing it
- Placing ingredients into the flour instead of dropping them
- Rolling flour bags from the bottom when tipping, to avoid having to fold them when disposing; and

- Starting the mixer on a slow speed until wet and dry ingredients are combined.

Self-check 1	Written test

Name…… ID…… Date…….

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

Short answer

1. List types of workplace hazards
2. Write types of manual handling and its control measure

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

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

Information Sheet 2- Cleaning equipment

2.1. Introduction

The fundamental objective of hygienic design is the prevention of contamination or adulteration of the baked goods. Contamination can come from raw materials (introduced into the processing environment), but the products can also be contaminated by the processing and packaging environment inside the plant. As an example, if a piece of equipment has an inadequately hygienic design, it will be difficult to inspect, maintain, clean, and/or sanitize. The residues (e.g., dirt, soil, and debris) can be retained in the cracks, crevices, and dead spaces of it and allow microorganisms it harbors to survive and multiply. These biological hazards may then cross-contaminate subsequent batches of product.

Bakeries need to properly incorporate hygienic considerations into the traditional technical requirements set in the initial stages of the design or purchase phase of equipment. Although it is not always easy and practical to follow this approach, the search for a comprehensive or “harmonic” set of requirements is necessary to avoid any endangerment of food safety. The long-term benefits of doing so are not only product safety, but also the potential to increase equipment life expectancy, reduce maintenance and, consequently, reduce operating costs.

This way, bakeries can reconcile and/or balance technical, operating, and budget requirements with hygienic expectations when acquiring new processing equipment or designing lines. Considerations include:

- Throughput (installed capacity)
- Size (relevant to use of floor space)
- Possibility of proper linkage/synchronization with the existing stages/flows within the production line
- Energy consumption (electricity, gas fuel, or a combination of these)
- Maintenance requirements and costs
- Automation level (degree of control and interaction between machine and operator)
- Price (cost of equipment plus commissioning and other charges)
- Hygienic design

The strategy for designing, constructing and installing hygienic equipment/machinery requires the following considerations:

- The intended use of the equipment (delimitation of usage in terms of products and processes)
- Identification of food safety hazards (chemical, biological and physical) associated with the food products that will be processed/handled in the machine
- Characteristics of the products that will be processed/handled in the machine (e.g., physical state, moisture content, acidity, microbiological and physicochemical stability, sensitivity of components).
- Risk assessment associated with each hazard.
- Methods and measures regarding equipment design which can eliminate/reduce risks associated with these hazards
- Further processing that will take place (subsequent processing equipment that could eliminate/prevent a given food safety hazard, e.g., washing, baking, pasteurization, metal detection)
- Application of the product and/or the expected consumers of the product (e.g., immunosuppressed patients, infants, children, adults, elderly)
- Cleaning and maintenance activities and conditions that will be applied to the machine
- Once food safety risks have been identified, the design and construction should take these into account. Personnel and environmental safety risks should also be assessed as these may influence the final hygienic design of machinery/equipment.

It is important to apply the eight considerations mentioned above when designing, constructing and installing machinery/equipment meant for baking applications. Baking plants have unique conditions regarding food processing equipment. These often have a combination of batch- and continuous-mode stages, with open and closed equipment within the production line; usually handling low-moisture (i.e., low water-activity) products such as crackers, biscuits, wafers, and high-moisture (i.e., high water-activity) products such as bread, rolls, dough/work-in-progress).

2.2. Closed and open equipment in the baking industry

In the practice, it is easier if the machinery/equipment is classified as open or closed equipment. This way, the design, construction, installation, cleaning, maintenance, and food safety conditions can be better planned and managed.

2.2.1 Open equipment

Open equipment is that which cannot be cleaned in place (CIP), and in which the products being processed or handled are not fully enclosed (i.e., isolated from the plant environment) by a continuous wall (e.g., piping, vacuum cavities, tubing, barrels).

Open equipment often requires:

- Cleaning out of place (COP)
- Manual cleaning
- Immersion cleaning

Open equipment must be manually dismantled for cleaning. Such tasks can be performed with open plant cleaning (OPC) techniques, like foam cleaning and rinsing with medium-pressure systems (e.g., up to 40 bar). Dismantled machine parts can be cleaned in COP baths. The time required will depend mostly on validation of microbiological monitoring results. The time will vary depending on the available cleaning equipment and utensils.

2.2.2 Closed Equipment

Equipment designed and constructed with its components fitted together tightly with no openings whatsoever to permit the entry of external agents (i.e., soil, human contact), and there is no possibility for accessing/touching the products held or contained by direct contact without prior dismantling.

In contrast to open equipment, closed equipment usually processes, handles, and conveys liquid and semi-solid products (e.g., process water, cleaning solutions, low-viscosity syrups, dough in bulk). Closed equipment must be cleaned in place (CIP) due to its access restrictions and typically confined spaces.

CIP includes the following general procedures or considerations:

- Pre-washing (rinsing with water)
- Alkaline clean

- Rinse
- Acid clean
- Rinse
- Disinfection
- Final rinse

Bakeries make use of open and closed equipment to process a wide variety of liquid, semi-solid, and solid products. This situation is rather uncommon elsewhere in the food industry since the products usually do not radically change regarding their physical state. Baking plants are special processing environments in which chemical reactions and physical transitions take place within the production line. All these conditions must be considered when designing, constructing and/or buying equipment.

Table 3 Open and closed equipment of a dough making plant

Open equipment	Closed equipment	Open and/or Closed
• Hoppers, bins, totes • Scales • Batch mixers/kneaders (e.g., horizontal, spiral, planetary) • Dividers, rounders, molders • Discrete conveying bands (i.e., transport of dough pieces) • Proofers	• Pipeline for liquid ingredient transport • Pipeline for pneumatic conveyance of dry ingredients • Pipe fittings (e.g., elbows, tees) • Continuous mixers • Bulk dough conveyors (e.g., augers, endless screws)	• Instrumentation and control devices (e.g., sensors, actuators) • Sensors: thermocouples, pt100, humidity sensors, manometers, pH sensors, viscosity sensors, laser devices for detecting empty/filled containers • Actuators: valves, motors

2.3. Useful terms regarding hygienic design of bakery equipment

Food-contact surface: All equipment surfaces that intentionally and unintentionally (e.g., due to splashing) come into contact with the product, or from which product or its condensate form may drain or drip down to the main product food container, including surfaces (e.g., tanks, mixers, tables, packaging materials) that may indirectly cross-contaminate food-contact surfaces or containers.

Dead space: Space wherein a product, sanitizing agents, or debris/soil can be trapped (i.e., become stagnant), or not be completely removed during the operation of cleaning.

Cleaning Out of Place (COP): Equipment is taken to a designated decontamination station for cleaning. COP requires dismantling/disassembling, washing, checking/inspecting, validating, and reassembling.

Cleaning In Place (CIP): Cleaning of equipment by circulation of flowing cleaning solutions, with water rinsing into and over surfaces in equipment or systems without dismantling them.

Dry cleaning: Cleaning designed or intended for equipment in which the products held or contained are not at risk of contamination after production runs. Products are usually non-hygroscopic and non-sticky. In general, dry cleaning can be an option for products with a water activity below 60%.3 Examples of dry cleaning include brushing, aspiration (vacuuming) and magnetic separation.

Wet cleaning: Cleaning in which water is used. Water can be used as a solvent to prepare sanitizing solutions.

Cleanable: Refers to equipment designed to be easily freed from dirt and other contaminants.

Crevice: Sharp, cleft-like, irregular opening of small depth that adversely affects clean ability. Readily accessible: Location that can be reached by an employee from the floor, a platform, or other permanent work area.

Readily removable: Refers to equipment components designed to be easily separated from the machine with or without the use of simple hand tools.

Seal: Closure of an aperture so as to effectively prevent the entry or passage of unwanted matter (e.g., gaskets).

Self-draining: A condition resulting from a combination of design, construction, installation, and surface finish to prevent the retention of liquid except for normal surface wetting.

There are two common techniques of cleaning bakery equipment. Those are:

- Steam
- Vacuum

Steam and vacuum away dirt grime in the kitchen equipment such as oven. The machines must be wet vacuums so that the equipment will dry out quickly as soon as they are cleaned.

Fib 10: Cleaning of dough making equipment

Self-check 2	Written test

Name…… ID…… Date…….

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

True or false

1. The fundamental objective of hygienic design is the prevention of contamination or adulteration of the baked goods

Short answer

Define the following terms

1. Dead space
2. Cleaning Out of Place (COP)
3. Cleaning In Place (CIP)
4. Dry cleaning
5. Wet cleaning

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

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

Information Sheet 3- Disposing waste with workplace policies and procedures

3.1. Introduction

The disposal of sewage and effluents (solid, liquid and gas) shall be in conformity with requirements of Factory / Environment Pollution Control Board. Adequate drainage, waste disposal systems and facilities shall be provided and they shall be designed and constructed in such manner so that the risk of contaminating food or the potable water supply is eliminated.

Waste (hazardous) storage shall be located in such that it does not contaminate the food process, storage areas, the environment inside and outside the food establishment and waste shall be kept in covered containers and shall not be allowed to accumulate in food handling, food storage, and other working areas. Periodic disposal of the refuse / waste be made compulsory. No waste shall be kept open inside the premise and shall not be discharged outside the premise, on the road or drainage system.

3.2. Types of waste in bakery plant

Process waste

- Dough
- Flour dust
- Sugar dust
- Burnt loaves or rejected loaves
- Market returned old bakery products

These can be sold out to suppliers who deals into cattle feeding. Precaution should be taken that none of these have contamination so that it can be used for cattle feeding.

Packaging waste

- Wrappers
- Tins
- Cardboard boxes
- Bags
- Cores
- Polythene

- Sacks
- Plastic Trays and Pallets

Most of these are can be recycled by packaging material suppliers

Solid waste

- Metallic scrap
- Wooden Pallets and other
- Papers
- Bakery waste water dry Sludge

Metallic scrap can be sold to scrap merchants, Dry Sludge and other can be sold to land filling contractors. Bakery waste water can be treated can be used for gardening and other cleaning purpose.

Other waste are

- Fat & oil contaminated
- Spent Oil from machinery

Could be sold to recyclers. Bakery waste recycling are being adopted by various companies to save cost and implement resource conservation.

Self-check 3	Written test

Name…… ID…… Date…….

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

Choose

1. Which one of the following is not Packaging waste
   A. Wrappers
   B. Tins
   C. Metallic scrap
   D. Cardboard boxes
2. Which one of the following is not Process Waste?
   A. Dough
   B. Flour dust
   C. Sugar dust
   D. Wrappers

Short answer

1. Write types of wastes in bakery and how it to be controlled

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

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

Information Sheet 4- Conducting work with workplace information

4.1 Workplace information

Each workplace relies on the exchange of information to carry out its daily business. Information is passed from employee to employee, customer to employee, supervisor to team member, supplier to customer, and so on. Dealing effectively with information and records is necessary and important for all organizations. The quantity and variety of information kept by an organisation can be huge. Information needs to be sorted into related groups so that it can be stored easily and found when needed. An organisation success depends largely on how well it manages its information. You need to be familiar with the type of information used in your job and the way records are organised so you can collect, file, store and find information quickly and easily. Finding and using information is a large part of many jobs, so knowing how to deal with it is an important workplace skill. Being confident and efficient in this skill helps you and your organisation succeed.

4.2 Workplace safety procedures

The most important concept to remember is that you are responsible for your own safety and the safety of others. Most safety practices are common sense. Unfortunately, they can be forgotten or overlooked unless you make safe practices a habit or an instinct. General Safety By doing things right, you and your co-workers will commit yourselves to safety on the job and everyone will benefit. Accidents occur in many ways but most often can be traced back to one of two basic factors: ignorance or carelessness.

4.3 Specification

A specification often refers to a set of documented requirements to be satisfied by a material, design, product, or service. A specification is often a type of technical standard. There are different types of technical or engineering specifications and the term is used differently in different technical contexts. They often refer to particular documents, and/or particular information within them. The word specification is broadly defined as "to state explicitly or in detail" or "to be specific.

Standard Operating Procedure for dough processing

Purpose: To ensure that the pastry products are properly formulated under conditions to minimize any food safety hazard by using GMPs in a warm environment.

Person Responsible: XXXY

Frequency: Daily

Procedure:

1. Lead hand or designate (using recipe provided) will measure quantities for each lot on scale in baking mixing area.
2. Record quantities used in each lot on formulation sheet as measured into mixer.
3. Mixer is operated as required to uniformly distribute ingredients throughout mix.
4. Mixed product is emptied into tub and hoisted over the divider.
5. Operator changes settings on divider unit as required for product size.
6. Operator weighs unit. Adjustments are made to volume for weight adjustment.
7. Operator places dough portions into oven conveyor
8. Operator removes baked pastry from tray after cooling
9. Operator places product into bag / bag is placed into vacuum packaging unit / vacuum is drawn (may be replaced with CO_2 gas for MAP) and sealed
10. Operator labels package
11. Operator places product into case / labels and closes case

Self-check 4	Written test

Name…… ID…… Date…….

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

1. What are the work place information?

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

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

Information Sheet 5- Environmental guidelines and legislative requirements

5.1 work place environmental guidelines

Workplace hazards include things such as slippery floors, loose floor mats, and sharp knives, as well as hazardous materials. It is important for all employees to be aware of hazards, even if they seem obvious. Employers should provide information and training on any safe work procedures related to the job site. Safe work procedures are specific directions for doing a task or operating equipment that may pose a risk or hazard to the worker. Workers should always ask their supervisor if there are any safe work procedures they need to be aware of and/or any written instructions they should be following. One of the main hazards in any workplace are cleaning products, some of which are everyday products that a person may not regard as hazardous, such as sanitizers and household cleansers. Cleaning products and all other materials that are potentially hazardous are governed by the Workplace Hazardous Materials Information System

5.2 Work place requirements

5.2.1 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.

5.2.2 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
- Aisles and walkways need to be at least 600mm wide and kept free of furniture or other obstructions
- Any walkways, boundaries or pathways shall be marked with 50mm wide with a contrasting colour 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

5.2.3 Work Areas

The layout of the work area should be designed to provide sufficient clear space between furniture, 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
- Equipment to be handled and the personal protective equipment that may be worn.

5.2.4 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 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
- Floors should be strong enough to support loads placed on them

5.2.5 Workstations

Work stations should be designed so workers are comfortable undertaking their task and allow for a combination of sit and standing tasks. For tasks undertaken in a seated position, workers should be provided with seating that:

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

5.2.6 Lighting

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

- The nature of the work activity
- The nature of hazards and risk in the workplace
- The work environment
- llumination levels, including both natural and artificial light
- The transition of natural light over the day
- Glare

5.2.7 Air Quality

Workplace are to be adequately ventilated which includes provision of fresh, clean air drawn from outside the workplace, uncontaminated from flues or other outlets and be circulated through the workplace. Workplace inside buildings may have natural ventilation, mechanical ventilation or air conditioning. An air-conditioning system should:

- Provide a comfortable environment in relation to air temperature, humidity and air movement
- Prevent the excessive accumulation of odors
- Reduce the levels of respiratory by-products, especially carbon dioxide, and other indoor contaminants that may arise from work activities

Self-check 5	Written test

Name…… ID…… Date…….

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

Short answer

2. Write the Examples of color-coding for containers and utensils
3. Define rework

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

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

References

1. Bread Research Institute of Australia 1989. Australian Bread making Handbook. Chapter 8 Bread faults and their correction.
2. Tafe Educational Books. Pp. 99–107. Doerry W 1995. Faults in bread & fermented goods. Bread making - Volume 1 - Baking Technology. American Institue of Bakers.Pp. 62-63.
3. New Zealand Institute for Crop & Food Research Limited. Bakers Correspondence Course Two. Bread Quality.
4. Adapted from Method 54-30A, Approved Methods of the American Association of Cereal Chemists, 10th Edition. 2000. St. Paul, MN.
5. American Home Economics Association. Handbook of Food Preparation. 8th edition. 1980.
6. Charley, H. Food Science. 2nd edition. New York: Macmillan Publishing Company. 1986.
7. Heywood, H. 1961. Techniques for the evaluation of powders I.-Fundamental properties of particles and methods of sizing analysis, Powder Metallurgy 7: 1–28.

Web addresses

1. https://youtu.be/BYfiV8zuu5Q
2. https://youtu.be/l1eqChP9VIg
3. https://youtu.be/VowERrTHlKY

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 Teaching, Training and Learning Materials (TTLM)

We would like also to express our appreciation to the TVET instructors and respective industry experts of Regional TVET Bureau, TVET College/ Institutes, Bishoftu Management institute, BEAR II UNESCO project and Federal Technical and Vocational Education and Training Agency (FTVET) who made contributions for the development of this curriculum with required standards and quality possible. This Teaching, Training and Learning Materials (TTLM) was developed on March 2021 at Bishoftu, Ethiopian Management Institute.

The trainers who developed the learning guide

Name	Qualification	Educational background	Institution	Region	E-mail
Tesfaye Mekuria	B	Food Science and Technology	Kolfe Industrial College	Addis Ababa	tesfayemekuriyaw48@gmail.com
Mulugeta Mangsitu	B	Food Science and Post-Harvest Technology	Hawassa Tegibared TVET Collage	Sidama	mulugetamangsitu@gmail.com
Adamu Bekena	B	Food Technology and Process Engineering	Yeka Industrial College	Addis Ababa	adamuberkana2@gmail.com
Teresa Negassa	B	Food Technology and Process Engineering	Kolfe Industrial College	Addis Ababa	Teresa87@gmail.com
Yared Mulugeta	B	Food Science and Post-Harvest Technology (BSc) and Food Process and Preservation Technology (MSc)	Butajura Poly Technic Collage	SNNPR	yayaet84@gmail.com

Federal TVET Coordinator

Full Name	Organization	Position	Telephone	E-mail
Fitsum Tilahun	Federal TVET Agency	TVET Curriculum TTLM Expert	0910115553	**tilahun.fitsum@gmail.com**