5

Basic Baking Principles

AFTER READING THIS CHAPTER, YOU SHOULD BE ABLE TO:

1. **Explain the factors that control the development of gluten in baked products.**
2. **Explain the changes that take place in a dough or batter as it bakes.**
3. **Prevent or retard the staling of baked items.**

WHEN YOU CONSIDER that most bakery products are made of the same few ingredients—flour, shortening, sugar, eggs, water or milk, and leavenings—you should have no difficulty understanding the importance of accuracy in the bakeshop, as slight variations in proportions or procedures can mean great differences in the final product. To achieve the desired results, it is not only important to weigh all ingredients accurately, as discussed in Chapter 2. It is also important to understand all the complex reactions that take place during mixing and baking, so you can control these processes.

In this chapter, you are introduced to bakeshop production through a discussion of the basic processes common to nearly all baked goods.

MIXING AND GLUTEN DEVELOPMENT

MIXING DOUGHS AND batters is a complex process. It involves more than just blending the ingredients together. To help you control the mixing processes or methods that apply to the products in this book, from bread doughs to cake batters, you need to understand the many reactions that take place during mixing.

Basic Mixing Processes

In general, there are three phases of mixing in the production of doughs and batters:

1. Blending the ingredients.
2. Forming the dough.
3. Developing the dough.

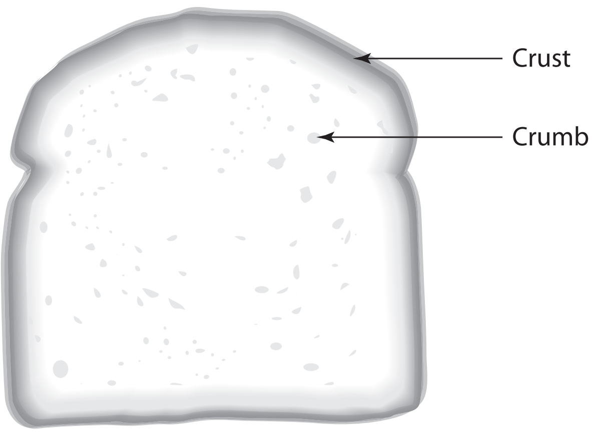
These phases overlap one another. For example, the dough begins to form and develop even before the ingredients are uniformly blended. Nevertheless, thinking of mixing processes in this way helps understand what is going on.

Different products contain different ingredients in varying proportions. Compare, for example, French bread dough with cake batter. The first has no fat or sugar, while the second has large quantities of both. The first has a smaller percentage of liquid in the mix, so it is a stiff dough, which bakes into a chewy product, rather than a semiliquid like the cake batter, which bakes into a tender product. Because of these and other differences, the two products require different mixing methods.

For much of the rest of this book, we focus a great deal on the correct mixing methods for the many products made in the bakery. For each of the mixing methods, a primary goal is to control the three stages of mixing just listed. In this discussion, we pay particular attention to three special processes that occur during mixing: air cell formation, hydration of the components, and oxidation.

Air Cell Formation

Air cells are visible in the cut surface of bread and other baked items. These air cells form the porous texture of the interior of the item. (The interior of baked goods is referred to by bakers as the *crumb*. In other words, a loaf of bread, for example, consists of two parts, the crust and the crumb.)



The crumb and crust of bread.

Air cell formation is a necessary part of the leavening process. The cells consist of open spaces surrounded by elastic cell walls made primarily of proteins such as gluten or egg albumin. When gases are formed by leavening agents, they collect inside the air cells. As the gases expand during baking, the cell walls stretch and enlarge. Eventually, the heat of baking causes the cell walls to become firm, giving structure and support to the baked item.

It is important to understand that no new air cells form during baking. All the air cells that enable leavening are formed during mixing. Air cells begin forming as soon as the mixing process starts. Plenty of air is present between the particles of flour and other dry ingredients. In some cases, as with certain cakes, additional air cells are introduced when certain liquid ingredients are added, as when egg foams are folded in.

Air cells are usually rather large at the beginning of mixing, but as mixing continues, these large cells become divided into smaller ones as gluten and other proteins develop and stretch to form more cell walls. This means the length of mixing determines the final texture of the item. In other words, proper mixing is required to get the desired texture.

Hydration

Hydration is the process of absorbing water. The many ingredients in baked goods absorb or react with water in different ways. All these processes are necessary for dough formation.

Starch is, by weight and volume, the largest component of bread doughs and most other doughs and batters. It does not dissolve in water, but it does attract and bind with water molecules and undergoes a change in form. Water molecules are not absorbed by the starch granules but become attached to the surface of them, forming a kind of shell around them. During baking, the heat causes the starch to absorb water and gelatinize. Gelatinization helps form the structure of baked goods; it is discussed later in this chapter (p. 101). Without hydration during mixing, gelatinization could not take place.

Proteins, too, are mostly insoluble in water, but they also attract and bind with water molecules during mixing. Gluten proteins in dry flour form tight coils. Once they come into contact with water, they begin to uncoil. Mixing then causes the straightened proteins to stick together and form long gluten fibers. In other words, water is essential for the formation of gluten.

Yeast requires water to become active and begin fermenting sugars and releasing carbon dioxide gas for leavening. Likewise, salt, sugar, and chemical leaveners such as baking powder have no effect on baked items in their dry form. They must be dissolved in water to carry out their many functions.

Water has many other functions. For example, controlling water temperature enables the baker to control the temperature of the dough or batter. And adjusting the quantity of water or other liquid enables the baker to adjust the consistency or softness of a dough or batter.

Oxidation

Oxidation is the process that occurs when oxygen from the air reacts with proteins and other components of flour during mixing. Oxidation increases when mixing times are long. Therefore, it is an important factor in the mixing of yeast doughs. When mixing times are short, as with products such as cakes, cookies, and pastry doughs, oxidation is less important and is not usually taken into consideration by the baker.

The most important effects of oxidation are on gluten proteins and pigments in the flour. During mixing, oxygen combines with gluten proteins and makes them stronger. This results in better structure for the bread dough. As mixing continues, oxygen combines with pigments in the flour and bleaches them, resulting in whiter bread. The same process, however, destroys some of the flavor and aroma, resulting in bread with less flavor.

Salt slows oxidation. Adding salt early in the mixing process delays the bleaching of pigments and results in a bread that is not as white but that has more flavor. If a whiter bread is desired, salt can be added later in the mixing process, after much of the pigment has already been oxidized.

You can see, then, that some oxidation is desirable, because it creates better gluten structure. But bakers try to avoid too much oxidation in order to preserve flavor. The amount of oxidation in bread dough is controlled by using the proper mixing time.

Controlling Gluten Development

Flour is mostly starch, as you know, but it is the content of gluten-forming proteins, not the starch, that concerns the baker most. Gluten proteins are needed to give structure to baked goods. Bakers must be able to control the gluten, however. For example, we want French bread to be firm and chewy, which requires a lot of gluten. On the other hand, we want cakes to be tender, which means we want very little gluten development in them.

Glutenin and *gliadin* are two proteins found in wheat flour and, in much smaller quantities, in a few other grains, such as rye and spelt. During mixing, these two proteins combine with water (that is, they are hydrated) and form a stretchable substance called *gluten*. As already explained, gluten forms when hydrated glutenin and gliadin proteins uncoil and attach to each other to form long chains. During mixing, these protein chains gradually stretch and become intertwined, forming an elastic network we call the ***gluten structure***.

Coagulation is the firming or hardening of gluten proteins, usually caused by heat. When gluten proteins coagulate during baking, they solidify into a firm structure. Soft, pliable bread dough is converted into firm bread crumb that holds its shape. A side effect of coagulation is that the proteins release much of the water they absorbed during mixing. Some of this water evaporates and some is absorbed by the starch.

Ingredient proportions and mixing methods are determined, in part, by how they affect the development of gluten. The baker has several methods for adjusting gluten development.

Selection of Flours

The proteins in wheat flour, especially in patent flour from hard wheat, form ***good-quality gluten***—that is, the gluten is strong and elastic. Proteins in clear flour (see p. 58) are abundant, but the gluten they form is of slightly lower quality.

Recall from Chapter 4 that wheat flours are classified as strong or weak, depending on their protein content. Strong flours come from hard wheat and have a high protein content. Weak flours come from soft wheat and have a low protein content. Thus, we use strong flours for breads and weak flours for cakes.

Rye proteins form poor-quality gluten and are not sufficient for normal breads, although a few specialty breads, heavy in texture, are made from all rye. Spelt also contains a small amount of gluten protein but it is of low quality. Most other grains, such as corn, buckwheat, and soy, contain no gluten proteins at all. To make bread from rye or other grains, the formula must be balanced with some high-gluten flour, or the bread will be heavy. (Refer back to Chapter 4 for greater detail on the protein content of flours.)

Fat and Other Tenderizers

Any fat used in baking is called a ***shortening*** because it shortens gluten strands. It does this by surrounding the particles and lubricating them so they do not stick together. Thus, fats are tenderizers. A cookie or pastry that is very crumbly, which is due to high fat content and little gluten development, is said to be ***short***. You can see why French bread has little or no fat, while cakes contain a great deal.

In the two-stage cake-mixing method (p. 382), the flour is mixed so thoroughly with shortening that very little gluten development takes place, even with several minutes of mixing.

Sugar is another tenderizer that inhibits gluten development. Sugar is ***hygroscopic*** (p. 66), meaning it attracts and binds to water. Water that is attracted to sugar is not available to hydrate gluten. For this reason, a special mixing method is used for some sweet doughs, in which the gluten is developed in a separate step, before the sugar is added (p. 108).

Water

Because gluten proteins must absorb water before they can be developed, the amount of water in a formula can affect toughness or tenderness.

In general, glutens absorb about twice their weight in water. Much of the water added to flour is absorbed by starch, so it is not all available to the proteins. Starving proteins of water keeps products tender by preventing gluten development. Piecrusts and crisp cookies, for instance, are made with very little liquid in order to keep them tender. Adding even a little extra water to these formulas activates more gluten and toughens the product.

Once all the gluten proteins are hydrated, additional water is of no use in developing gluten. In fact, if a great deal of water is added, the glutens are diluted and weakened.

The condition of the water used in bread doughs, specifically hardness and pH, also affects gluten. ***Water hardness*** refers to the mineral content of the water, especially its calcium content. Water with a high mineral content is called ***hard***. The minerals in hard water strengthen gluten, often too much, making the dough too elastic and hard to work. Water that is too soft makes dough that is too slack and sticky. Either water treatments or dough conditioners can be used to counteract these effects.

The ***pH*** of water is a measure of its acidity or alkalinity, on a scale of 0 to 14. A strong acid has a pH of 0, while a strong alkali has a pH of 14. Pure water, being neutral, has a pH of 7. The mineral content of water often raises its pH. The strongest gluten development takes place with a slightly acid pH of 5 to 6. The tenderness of a baked item can be adjusted by adding either an acid, such as fruit juice, to lower the pH beyond the 5 to 6 range, or adding an alkali, such as baking soda, to raise the pH above this range. Sourdoughs, being acidic, make doughs that are softer and stickier than regular yeast doughs.

Mixing Methods and Mixing Times

When the ingredients of a dough are mixed, three important processes take place:

1. The mixing action blends the water with the flour so the flour proteins can hydrate. This is the first step in the development of gluten.
2. Air is mixed into the dough. The oxygen in the air reacts with the gluten and helps strengthen it and make it more elastic.
3. The mixing action develops the gluten by stretching and aligning the gluten strands into an elastic network.

In the case of bread dough, the dough is soft and sticky at first. As the gluten develops, the dough becomes smooth and less sticky. When the dough reaches the ideal state of development, it is said to be *mature*. If mixing continues, gluten strands break and the dough becomes sticky and stringy. Overmixing results in poor loaf volume, because the broken gluten is no longer able to support the structure.

In products for which tenderness is desired, such as cookies, cakes, and short dough, the mixing time is kept short. Some gluten development is desired for these products, or they will be too crumbly. Pie doughs will not hold together, biscuits will slump rather than rise properly, and cookies will crumble. However, overmixing results in toughness.

Dough relaxation is an important technique in the production of most doughs. After mixing or kneading, gluten becomes stretched and tight. At this point, it becomes difficult to work or mold the dough. A period of rest or relaxation allows the gluten strands to adjust to their new length and shape, and they become less tight. The dough can then be handled more easily, and it has less of a tendency to shrink.

Leavening

Yeast fermentation helps gluten development because the expansion of air cells by yeast stretches the gluten, just as mixing does. In addition, acids produced by fermentation also help to develop gluten structure. After a period of fermentation, the gluten in yeast dough is stronger and more elastic.

While it strengthens gluten, leavening also tenderizes the product. This is because the cell walls become thinner as they are stretched, making the finished product easier to chew.

Too much fermentation, on the other hand, can hurt the gluten structure, because the gluten becomes overstretched, causing its strands to tear and lose their elasticity. Overfermented doughs have poor texture, similar to overmixed dough.

Adding too much baking powder to a product such as a cake batter has an effect similar to overfermenting a yeast dough. The protein structure of the batter is stretched too far and can't hold, so it is likely to collapse. The result is a dense cake with poor volume.

Temperature

Gluten develops more at a warm room temperature than at cold temperatures. Thus, the ideal temperature for mixing bread dough is 70° to 80°F (21° to 27°C). By contrast, tender products such as pie dough are best made with ice-cold water and mixed at a cool temperature, to limit gluten development.

Other Ingredients and Additives

Salt is an important additive in yeast doughs. Not only does it help regulate yeast fermentation but also it strengthens gluten and makes it more elastic. Yeast doughs without salt are harder to handle, and the gluten is more likely to tear.

Because salt strengthens the gluten bonds, more mixing time is required to develop the structure. For this reason, some bakers wait until later in the mixing period to add the salt. This technique has an important disadvantage, however. Salt also slows oxidation of the flour, so delaying the addition of salt means that the dough has more time to oxidize before the salt is added. This results in loss of flavor (review p. 97 for an explanation of oxidation). For best flavor, add the salt at the beginning of mixing time.

Bran inhibits gluten development because it prevents some of the gluten strands from sticking together, and the sharp edges cut through gluten strands that have formed.

KEY POINTS TO REVIEW

- What are the three phases of mixing in the production of doughs and batters?
- What is the importance of air cells in doughs and batters?
- What is gluten? How is it developed? What factors control its development?

Whole-grain breads are likely to be denser or heavier in texture. The texture of the mixed dough is not smooth and silky, and it tears easily.

Other solid food particles added to bread dough, such as herbs, nuts, olives, grated cheese, and even ground spices have a similar effect on gluten development.

Dough conditioners contain a mixture of ingredients, one of whose main functions is to strengthen gluten. Selection of dough conditioners depends on many factors, such as the hardness and pH of the water and the selection of flours.

Milk, including pasteurized milk, contains an enzyme that interferes with gluten development. Milk used in yeast doughs should be scalded by heating it to a simmer (180°F or 82°C) and then cooling before incorporating it in the dough.

THE BAKING PROCESS

THE CHANGES TO a dough or batter as it bakes are basically the same in all baked products, from breads to cookies and cakes. You should know what these changes are so you can learn how to control them.

There are seven stages in the baking process, described in this section. Be aware that many of these steps happen at the same time, not one after the other. For example, escape of water vapor and other gases begins almost at once, but becomes more rapid later in the baking process.

Melting of Fats

Solid fats mixed into a dough or batter trap air, water, and some leavening gases. When the fats melt, these gases are released and the water turns to steam, both of which contribute to leavening.

Different fats have different melting points, but most fats used in baking melt between 90° and 130°F (32° and 55°C). Gases released early in baking are more likely to escape because the structure isn't set enough to trap all of them. This is why puff pastry made with butter, with a low melting point, doesn't rise as high as puff pastry made with puff paste shortening. On the other hand, the high melting point of shortening makes the pastry unpleasant to eat.

Formation and Expansion of Gases

The gases primarily responsible for leavening baked goods are carbon dioxide, which is released by the action of yeast and by baking powder and baking soda; air, which is incorporated into doughs and batters during mixing; and steam, which is formed during baking.

Some gases—such as the carbon dioxide in proofed bread dough and the air in sponge cake batters—are already present in the dough. As they are heated, the gases expand and leaven the product.

Some gases do not form until heat is applied. Yeast and baking powder produce gases rapidly when first placed in the oven. Steam is also formed as the moisture of the dough is heated.

As the product rises, the cell walls become thinner as they are stretched by the expanding gases. This tenderizes the product.

Production and expansion of gases starts immediately, at the beginning of baking. Yeast dies at 140°F (60°C) and stops producing carbon dioxide. Production of steam continues throughout the baking process.

As the gases form and expand, they become trapped in a stretchable network created by the proteins in the dough. These proteins are primarily gluten and sometimes egg protein.

Killing of Yeast and Other Microorganisms

In addition to yeast, doughs may contain other organisms, including bacteria and molds. Most of these, including yeast, die when the interior temperature of the item reaches about 140°F (60°C), although some microorganisms may survive to a slightly higher temperature.

When yeast dies, fermentation stops and no more carbon dioxide gas is released.

Coagulation of Proteins

Gluten and egg proteins are the proteins primarily responsible for the structure of most baked goods. They can provide this structure only when they are heated enough to coagulate, or become firm. Recall that proteins consist of molecules in the form of long chains. This process begins slowly, at 140° to 160°F (60° to 70°C). Gradually, these chains bond to each other to form a solid structure. To visualize this process, think of eggs, which are liquid when cold but become firmer as they are heated, until they are quite solid.

While this process is going on, gases are continuing to expand and the protein strands continuing to stretch. Finally, when coagulation is complete, the air cells can no longer expand and the product stops rising. Much of the water that bonded with the protein during mixing is released and either evaporates or is absorbed by starch. Once the protein structure has completely coagulated, the baked item is able to hold its shape.

The exact temperatures at which coagulation begins and is completed depend on several factors, including the other ingredients that are present. Sugars and fats, especially, affect the coagulation temperature of protein. Most proteins, however, are completely coagulated by the time they reach 185°F (85°C).

Correct baking temperature is important. If the temperature is too high, coagulation starts too soon, before the expansion of gases reaches its peak. The resulting product has poor volume or a split crust. If the temperature is too low, the proteins do not coagulate soon enough, and the product may collapse.

Gelatinization of Starches

Starch molecules make up the majority of most baked goods. Thus, starch is an important part of the structure. Although starches by themselves generally can't support the shape of the baked item, they give bulk to the structure.

Starches make a softer structure when baked than proteins do. The softness of the crumb of baked bread is due largely to the starch. The more protein structure there is, the chewier the bread.

Starch molecules are packed into tiny, hard granules. These granules attract water during mixing and, although the water is not absorbed by the granules when cold, it bonds to the outside of the granules. As they are heated during baking, the water is then absorbed into the granules, which swell greatly in size. Some of the starch granules break open and release starch molecules. During this process, starch molecules bond with any available water. This is why the interior of baked doughs are fairly dry, while unbaked doughs are moist. Most (but not all) of the water is still present but has bonded with starch.

This process, called ***gelatinization***, begins when the interior reaches about 105°F (40°C) and continues throughout baking, or until about 200°F (95°C).

Depending on how much water is present in the dough or batter, not all the starch gelatinizes, because not enough water may be available. In dry products such as cookies and pie dough, a lot of the starch remains ungelatinized. In products made from a batter with a high water content, such as some cakes, a larger percentage of the starch gelatinizes.

Escape of Water Vapor and Other Gases

Throughout the baking process, some of the water turns to steam and escapes into the air. If this takes place before the proteins coagulate, it contributes to leavening. In addition to steam, carbon dioxide and other gases escape as well. In yeast products, alcohol produced by the fermentation process is one of these gases.

Another result of the loss of moisture is the beginning of crust formation. As moisture is lost from the surface, the surface becomes harder. The crust begins to form even before browning starts. Baking breads with steam injected into the oven slows crust formation by delaying the drying of the surface. Delaying crust formation allows the bread to continue rising.

A measurable amount of moisture is lost during baking. If a baked product of a specific weight is required, you must allow for moisture loss when scaling the dough. For example, to get a 1-pound loaf of baked bread, it is necessary to scale about 18 ounces of dough. The percentage of weight loss varies greatly, depending on such factors as proportion of surface area to volume, baking time, and whether the item is baked in a pan or directly on the oven hearth.

Note that loss of moisture goes on even after the product is removed from the oven, as it cools.

Crust Formation and Browning

As just described, crust is formed as water evaporates from the surface and leaves it dry. Browning cannot occur until the surface temperature rises to about 300°F (150°C), and this can't happen until the surface dries. Browning begins before the interior of the item is completely baked and continues throughout the rest of the baking period.

Browning occurs when chemical changes occur to starches, sugars, and proteins. Although this is often referred to as *caramelization*, it is only part of the story. Caramelization involves only the browning of sugars. A similar process, called the *Maillard reaction*, causes most of the crust browning of baked goods. This process occurs when proteins and sugars together are subjected to high heat. Maillard browning also takes place on the surface of meats and other high-protein foods.

The chemical changes caused by caramelization and Maillard browning contribute to the flavor and appearance of the baked item. Milk, sugar, and egg, when included in doughs and batters, increase browning.

AFTER BAKING

MANY OF THE processes that take place during baking continue after the item is removed from the oven, while some of these processes reverse. We can divide this period into two stages, cooling and staling, although there is no exact dividing line between the two. In a sense, staling begins immediately, and cooling is only the first part of this process.

Cooling

Moisture continues to escape after the item is removed from the oven. At the same time, cooling begins, which causes the gases still inside the item to contract. If the protein structure is completely set, the product may shrink slightly but hold its shape. If the product is underbaked, however, the contraction of gases may cause it to collapse.

When baked goods are removed from the oven, the surface is drier than the interior crumb. During cooling, the moisture content tries to equalize throughout the item. As a result, crisp crusts gradually become softer.

Proteins continue to solidify and bond to one another during cooling. Many products are fragile when they are still hot, but cooling makes them firm enough to handle. It is best not to handle or cut most baked goods until they have cooled.

Fats that melted during baking resolidify. This process also helps make the texture firmer.

Starches continue to gelatinize while the interior is still hot. Also, starch molecules bond with each other and become more solid as the product cools. This process, called *starch retrogradation,* is responsible for staling.

Staling

Staling is the change in texture and aroma of baked goods due to a change of structure and a loss of moisture by the starch granules. Stale baked goods have lost their fresh-baked aroma and are firmer, drier, and more crumbly than fresh products. Prevention of staling is a major concern of the baker, because most baked goods lose quality rapidly.

As indicated, starch retrogradation begins as soon as the item begins to cool. As starch molecules bond with each other, the starch forces out moisture and becomes harder and drier. Even though this moisture may then be absorbed by other ingredients such as sugar, the result is that the texture of the item feels drier. Because this is a chemical reaction of the starch, breads become drier in texture even when tightly wrapped.

Starch retrogradation is more rapid at refrigerator temperatures than at room temperature, but it nearly stops at freezer temperatures. Thus, bread should not be stored in the refrigerator. It should be left at room temperature for short-term storage or frozen for long-term storage.

Chemical staling, if it is not too great, can be partially reversed by heating. Breads, muffins, and coffee cakes, for example, are frequently refreshed by placing them briefly in an oven. Remember, however, that this also results in more loss of moisture to the air, so the items should be reheated only just before they are to be served.

Loss of crispness is caused by absorption of moisture, so, in a sense, it is the opposite of staling. The crusts of hard-crusted breads absorb moisture from the crumb and become soft and leathery. Reheating these products to refresh them not only reverses chemical staling of the crumb but also recrisps the crusts.

Loss of crispness is also a problem with low-moisture products such as cookies and piecrusts. The problem is usually solved by proper storage in airtight wraps or containers to protect the products from moisture in the air. Prebaked pie shells should be filled as close to service time as possible.

In addition to refreshing baked goods in the oven, three main techniques are used to slow staling:

1. **Protecting the product from air.** Two examples of protecting baked goods are wrapping bread in plastic and covering cakes with icing, especially icing that is thick and rich in fat.

   Hard-crusted breads, which stale rapidly, should not be wrapped, or the crusts will quickly become soft and leathery. These bread products should always be served very fresh.

2. **Adding moisture retainers to the formula.** Fats and sugars are good moisture retainers, so products high in these ingredients keep best.

   Some of the best French bread has no fat at all, so it must be served within hours of baking or it will begin to stale. For longer keeping, bakers often add a very small amount of fat and/or sugar to the formula.

3. **Freezing.** Baked goods frozen before they become stale maintain quality for longer periods. For best results, freeze soon after baking in a blast freezer at −40°F (−40°C), and maintain at or below 0°F (−18°C) until ready to thaw. Breads should be served quickly after thawing. Frozen breads may be reheated with excellent results if they are to be served immediately.

   Refrigeration, on the other hand, speeds staling. Only baked goods that could become health hazards, such as those with cream fillings, are refrigerated.

KEY POINTS TO REVIEW

- What are the seven changes that take place in baked goods during the baking process?
- Why is protein coagulation important in the baking process?
- What is staling? How can it be controlled?

TERMS FOR REVIEW

crumb	gluten	mature (dough)	Maillard reaction
hydration	coagulation	dough relaxation	starch retrogradation
oxidation	shortening	dough conditioner	staling
glutenin	water hardness	gelatinization	
gliadin	pH	caramelization	

QUESTIONS FOR DISCUSSION

1. List and describe briefly the three stages of mixing a dough or batter.
2. What are air cell walls made of? Describe how air cells are formed. Name two functions of air cells.
3. Describe what happens when gluten proteins come in contact with water during mixing.
4. What is the result of overmixing on bread dough? Pie dough?
5. Discuss seven factors that affect the development of gluten in batters and doughs.
6. Why do some cakes fall if they are removed from the oven too soon?
7. Which kind of cake would you expect to have better keeping qualities: a sponge cake, which is low in fat, or a high-ratio cake, which is high in both fat and sugar?

6

Understanding Yeast Doughs

AFTER READING THIS CHAPTER, YOU SHOULD BE ABLE TO:

1. **List and describe the 12 basic steps in the production of yeast goods.**
2. **Explain the three basic mixing methods used for yeast doughs.**
3. **Explain the three basic techniques for developing yeast doughs, based on mixing times and speeds.**
4. **Describe the principal types of straight dough processes, and list the advantages of sponge processes.**
5. **Understand and control the factors affecting dough fermentation.**
6. **Recognize and correct faults in yeast products.**

IN ITS SIMPLEST form, bread is nothing more than a baked dough made of flour and water and leavened by yeast. In fact, some hard-crusted French breads contain only these ingredients, plus salt. Other kinds of bread contain additional ingredients, including sugar, shortening, milk, eggs, and flavorings. But flour, water, and yeast are still the basic building blocks of all breads.

Yet, for something that seems so simple, bread can be one of the most exacting and complex products to make. Success in bread making depends largely on your understanding of two basic principles: gluten development, which was discussed in Chapter 5, and yeast fermentation, which was introduced in Chapter 4 and is described in further detail here.

This chapter focuses on the basic procedures in the production of many kinds of yeast products. Special attention is given to mixing methods and to control of fermentation. In Chapter 8, you'll see these procedures applied to specific formulas.

YEAST PRODUCT TYPES

ALTHOUGH ALL YEAST doughs are made according to the same basic principles, it is useful to divide yeast products into the three categories defined in this section.

Lean Dough Products

A *lean dough* is one that is low in fat and sugar. Products made from lean doughs include the following:

- Hard-crusted breads and rolls, including French and Italian breads, kaiser rolls and other hard rolls, and pizza. These are the leanest of all bread products.
- Other white and whole wheat breads and dinner rolls. These have a higher fat and sugar content and sometimes also contain eggs and milk solids. Because they are slightly richer, they generally have soft crusts.
- Breads made with other grains. Rye breads are the most common. Many varieties of rye bread are produced, with light or dark flours or with pumpernickel flour, and with various flavorings, especially molasses and caraway seeds.

Rich Dough Products

There is no exact dividing line between rich and lean doughs but, in general, *rich doughs* are those that contain higher proportions of fat, sugar, and sometimes eggs. Among the products made from rich doughs are:

- Nonsweet breads and rolls, including rich dinner rolls and brioche. These have a high fat content, but their sugar content is low enough to allow them to be served as dinner breads. Brioche dough, made with a high proportion of butter and eggs, is especially rich.
- Sweet rolls, including coffee cakes and many breakfast and tea rolls. These have high fat and sugar content and usually contain eggs. They generally have a sweet filling or topping.

Laminated or Rolled-In Yeast Dough Products

Rolled-in doughs or *laminated doughs* are those in which a fat is incorporated into the dough in many layers using a rolling and folding procedure. The alternating layers of fat and dough give the baked product a flaky texture.

Laminated doughs vary in sugar content from about 4% for some croissant doughs to 15% or more for some Danish doughs. However, most of the sweetness of laminated yeast dough products comes from the fillings and toppings.

Croissant and Danish doughs are the main laminated yeast dough products. In general, Danish dough products contain eggs, while croissants do not, although there are exceptions to this rule.

LAMINATED DOUGHS

Laminated doughs—doughs that consist of many layers of fat sandwiched between layers of dough—include yeast-leavened doughs, such as Danish and croissant doughs, and doughs that contain no yeast but are leavened by steam and air only, namely, the various types of puff pastry.

The procedure for enclosing the fat and rolling and folding the dough to increase the number of layers is similar for these two types of products, so they are often discussed together in a pastry unit, separate from yeast doughs. It is important to realize, however, that handling and making up yeast doughs is fundamentally different from handling and making up doughs for other pastries. Remember that fermentation continues in Danish dough while it is being rolled, folded, and made up. As a result, it handles differently from puff pastry, even though the steps in the rolling procedure are similar. Careless handling can easily result in overfermented doughs of lower quality.

Puff pastry, on the other hand, can be rolled and made up over a longer period without loss of quality, as can other pie and pastry doughs that contain no leavening agents. Including croissant and Danish doughs with other yeast-leavened doughs emphasizes the production principles and procedures that all yeast doughs have in common.

YEAST DOUGH PRODUCTION

THERE ARE 12 basic steps in the production of yeast breads. These steps are generally applied to all yeast products, with variations depending on the particular product. In particular, many of the handcrafted artisan breads that have become popular require more complex procedures. These procedures are reserved for discussion in Chapter 7, where we take the time to describe them fully. In this chapter we give you the information you need to produce the conventional yeast formulas in Chapters 8 and 9. To prepare the sourdough breads and some of the specialty items in Chapter 8, you are advised to prepare by reading Chapter 7.

The 12 steps are listed here. The next section provides a more in-depth explanation of each including the basic procedures. Later in the chapter, dough making and fermentation are discussed in greater detail. Specific makeup procedures are included with the formulas in Chapters 8 and 9.

1. Scaling ingredients
2. Mixing
3. Bulk fermentation
4. Folding
5. Dividing (scaling or portioning of dough)
6. Preshaping or rounding
7. Bench-proofing or intermediate proofing
8. Makeup and panning
9. Proofing
10. Baking
11. Cooling
12. Storing

As you can see, mixing ingredients into a dough is only one part of a complex procedure.

Scaling Ingredients

All ingredients must be weighed accurately.

Water, milk, and eggs may be measured by volume. They are scaled at 1 pint per pound (1 kg/L). However, it is more accurate to weigh these liquids (p. 19), especially if quantities are large. Procedures for weighing ingredients in the bakeshop are discussed in detail in Chapter 2.

Take special care when measuring spices and other ingredients used in very small quantities. This is particularly important with salt, which affects the rate of fermentation (p. 90).

Mixing

Mixing yeast doughs has three main purposes:

- To combine all ingredients into a uniform, smooth dough.
- To distribute the yeast evenly throughout the dough.
- To develop the gluten.

The first half of Chapter 5 is devoted to a detailed explanation of the mixing process for doughs and batters in general. This information is important for all dough products and should be reviewed as necessary. The next section contains additional information and procedures needed for the proper mixing of yeast doughs.

The three phases of mixing in the production of doughs and batters are described on page 96. During the first phase, flour and other dry ingredients are hydrated, or combined with liquid ingredients. Bread bakers often refer to this phase as the ***pickup stage*** because the loose dry ingredients are gradually picked up and incorporated by the developing dough.

In the second phase, all the dry ingredients are hydrated and form a rough dough. Bakers call this the ***cleanup stage*** because the dough forms enough to pull away from (or clean up) the bowl into a compact mass.

In the development phase, the dough is further mixed and gluten is developed to the desired degree. Bakers often divide this phase into two stages, the ***initial development phase***, in which the dough still appears rough and undermixed, and the ***final development stage***, in which the gluten becomes smooth and elastic.

Mixing machines develop doughs by imitating the action of hand kneading. The dough arm or other agitator (depending on the type of mixer) repeatedly stretches the dough and folds it

YEAST DOUGH METHODS AND TECHNIQUES

In this discussion, we describe procedures for combining ingredients and incorporating them into a dough, including the straight dough method and the sponge method. As we do throughout the book, we refer to these as "mixing methods."

In the production of yeast doughs, however, bakers often use the expression "mixing method" in different ways. Later in this chapter, we describe three techniques for developing doughs, using different mixing times and fermentation periods. In many references, these are also called "mixing methods." However, in order to avoid confusion, in this book, we refer to them as "mixing techniques" rather than as "mixing methods."

over on itself. This action helps gluten strands not only to form but also to align themselves into a network to make a smooth dough.

Three principal mixing methods are used for yeast doughs: the straight dough method, the modified straight dough method, and the sponge method (also called *the sponge-and-dough method*).

Straight Dough Method

In its simplest form, the ***straight dough method***, also called the ***direct dough method***, consists of only one step: Combine all ingredients in the mixing bowl and mix. With fresh yeast, many bakers make good-quality products using this procedure. However, the yeast may not be evenly distributed in the dough. It is therefore safer to mix the yeast separately with a little of the water. If active dry yeast is used, it is, of course, essential to mix the yeast with water before incorporating it in the dough.

Instant dry yeast, on the other hand, need not be blended with water for use because it is moistened and becomes active in the dough so quickly. The usual method for incorporating instant dry yeast is to mix it in dry form with the flour.

PROCEDURE: Straight Dough Mixing Method for Yeast Products

1a. In the bowl that is to be used for mixing the dough, soften fresh yeast or active dry yeast in a little of the water.

Fresh yeast: Mix with about 2 times its weight in water, or more.

- Ideal water temperature: 100°F (38°C).

Active dry yeast: Mix with about 4 times its weight in water.

- Ideal water temperature: 105°F (40°C).

1b. If using instant dry yeast, mix it directly with the flour.

2. Add the flour to the mixing bowl.

3. Add the remaining ingredients to the top of the flour in the mixing bowl.

4. Mix to a smooth, developed dough.

Modified Straight Dough Method

For rich sweet doughs, the straight dough method is modified to ensure even distribution of the fat and sugar. In this procedure, the fat, sugar, eggs, and flavorings are first blended until uniform before the dough is developed.

PROCEDURE: Modified Straight Dough Method

1. If using fresh or active dry yeast, soften the yeast in part of the liquid, using a separate container. If using instant dry yeast, mix it with the flour.
2. Combine the fat, sugar, salt, milk solids, and flavorings and mix until well combined, but do not whip until light.
3. Add the eggs gradually, but as fast as they are absorbed.
4. Add the liquid; mix briefly.
5. Add the flour and yeast. Mix to a smooth dough.

Sponge Method

Sponge doughs are prepared in two stages. For this reason, the procedure is often called the ***sponge-and-dough method***. This procedure gives the yeast action a head start.

The first stage is called a *sponge*, a *yeast starter*, or a *yeast pre-ferment*. All of these terms can mean the same thing (although bakers often reserve the term *sponge* specifically for a yeast pre-ferment with a hydration (water content) of about 60 to 63%). Pre-ferments are discussed in more detail in Chapter 7.

There are many variations of the *sponge method*, so the steps indicated in the procedure here are general. Variations on the sponge method are discussed in more detail in Chapter 7, because they play an important part in the production of artisanbreads. The procedure given here, however, will enable you to prepare the conventional sponge doughs in this book.

A note on the system of baker's percentages (pp. 23–24) is in order here. There are two possible ways to express percentages when using a sponge:

1. Consider the sponge or pre-ferment as a separate formula. Express the flour in the sponge as 100%. Then, in the main formula, express the total weight of the sponge as a percentage of the flour weight in the main formula.
2. Consider the sponge as part of the main formula. Express the flour in the sponge as a percentage of the total flour in the complete formula.

Each method has advantages, and bakers have their own preferences. In this book, both methods are used, depending on the formula, so you can have experience working with each.

PROCEDURE: Sponge Method

1. Combine part or all of the liquid, all of the yeast, and part of the flour (and, sometimes, part of the sugar). Mix into a thick batter or soft dough (a). Let ferment until double in bulk (b).
2. Fold (punch down) and add the rest of the flour and the remaining ingredients. Mix to a uniform, smooth dough.

A

B

KEY POINTS TO REVIEW

- What are the three main types of yeast doughs?
- What are the 12 steps in yeast dough production?
- What are the three main mixing methods for yeast doughs? What are the steps in each?

BREAD MIXING: A HISTORICAL PERSPECTIVE

For most of human history, bakers mixed bread dough by hand. Because so much manual labor was involved, bakers didn't completely develop the dough by handkneading, but relied on longer fermentation and numerous folds to complete the development of gluten.

Not until the 1800s did machines for mixing dough become available. The first of these machines were slow and inefficient. Although they saved a great deal of hand labor for bakers, they were not able to mix doughs much more quickly than by hand. As with handmixing, early mechanical mixing techniques combined short mixing periods with longer fermentation and several folds. This technique is comparable to the short mix technique described in the text. Breads made this way resemble handmixed breads.

As mixers became faster and more powerful (around the middle of the twentieth century), bakers found that they could mix doughs longer, give them a much shorter bulk fermentation, and, as a result, make larger quantities in a shorter time. This so-called intensive mix technique made bakeries much more efficient. Being able to get a dough ready for dividing and shaping into loaves in only an hour, rather than four to five hours as before, meant that bakers suddenly had shorter workdays. The entire process, from scaling ingredients to removing the baked bread from the oven now took less than 5 hours instead of 10 hours or more as before.

Eventually, however, people began to realize that bread had lost much of its flavor. Longer mixing means that more oxygen is mixed with the dough, destroying pigments, flavor, and aroma. Also, short fermentation gives little opportunity for flavors to develop. In an effort to regain some of the qualities of old-fashioned "short mix" breads without forcing bakers to go back to their 12-hour workdays, experts developed the improved mix technique, in which shorter mixing times can be combined with bulk fermentation periods that are only slightly longer.

Mixing Times and Speeds

The first two purposes of mixing—combining the ingredients into a dough and distributing the yeast—are accomplished during the first part of this step. The remaining time is necessary to develop the gluten.

To understand mixing times and speeds in detail, it is important to remember that gluten development occurs not only during mixing. It continues during bulk fermentation and folding. Therefore, mixing times, fermentation periods, and number of folds must be balanced. Short mixing time, for example, can be balanced against a long fermentation with numerous folds to yield a properly developed dough. By contrast, if long mixing is followed by long fermentation, the result is an overdeveloped dough.

Three basic mixing techniques are used for most yeast products: the ***short mix*** technique, the ***improved mix*** technique, and the ***intensive mix*** technique (see sidebar at left). Following the explanation of these techniques, the basic information is summarized in the two tables following this discussion (p. 112)

Short Mix

The short mix technique combines a short mix and long bulk fermentation. In a typical planetary mixer, mixing time is 3 to 4 minutes to incorporate ingredients, plus an additional 5 to 6 minutes to develop the gluten. All mixing time is at low speed. Of the three techniques, this is the closest to handmixing. Because of the short mixing time, the dough is very underdeveloped at the end of the mixing period. Gluten strands have formed but are not well aligned into a smooth dough. As a result, air cells are uneven in size, resulting in an open, irregular crumb structure in the finished bread.

Furthermore, because the dough is underdeveloped after mixing, a long fermentation time is necessary, 3 to 4 hours or even longer. During this long bulk fermentation time, the dough is folded often, generally 4 or 5 times (see p. 114). Because the dough is less developed, it can't hold as much gas and rises less during final proof and baking. Final proof is less than for other mixing techniques.

Shorter mixing also means less oxidation, because less air is mixed into the dough. Less oxidation means less dough strength (a disadvantage). On the other hand, it also means less loss of flavor and color (an advantage). (See the discussion of oxidation on p. 97.)

The short mix technique is especially suitable for lean doughs with an open crumb, such as baguettes and ciabatta. It is also used for laminated doughs, such croissant dough, in which additional dough development takes place when the butter is rolled in.

Improved Mix

The improved mix technique combines medium mixing and bulk fermentation times. During mixing, the dough is first mixed for 3 to 4 minutes at low speed to incorporate ingredients. Then mixing is continued an additional 5 minutes at medium speed. (Note that the total mixing time is about the same as in the short mix technique, but because second speed is used to develop the gluten, the dough is much more developed than in the short mix.)

Because the dough is more developed after mixing, a shorter fermentation time is needed, usually 1 to 2 hours. Only one or two folds are given during this time.

Improved mix doughs have a slightly whiter color than short mix doughs, due to oxidation, but they still retain good flavor. Also, the crumb structure is tighter than in short mix products.

This technique is used for many yeast products but is especially appropriate for lean doughs with a slightly open, more regular crumb, and for sweet doughs.

Intensive Mix

The intensive mix technique combines long mixing with short fermentation. After an initial 3 to 4 minutes at first speed to incorporate ingredients, the dough is then mixed for 8 to 15 minutes at second speed. When the dough leaves the mixer, it has a well developed gluten structure.

Because the dough is well developed, it can tolerate only a short bulk fermentation, generally about 30 minutes. In most cases, the dough is not folded.

Long mixing means high oxidation, resulting in a very white crumb and only slight aroma and flavor. The crumb is tight and regular.

The intensive mix technique is especially appropriate for nonlaminated doughs high in fat, such as stollen (p. 188) and brioche (p. 192). When a short production time is important, it can be used for many other breads and rolls, but because of the high level of oxidation, their flavor will be decreased. In Chapter 8 you will find many bread and roll formulas using the intensive mix, because they give you practice with a full range of bread-making procedures in a manageable period of time.

The intensive mix is not appropriate for traditional sourdoughs containing no commercial yeast.

Short mix gluten window.

Other Considerations

Note the following in regard to the three mixing techniques:

- Mixing times in the preceding discussions and in the "Mixing Times, Fermentation, and Folds" table on page 112 are approximate times for a full batch in a typical planetary mixer. Other kinds of mixer may require different times.
- First and second speeds on some machines may be faster than on others. Also, the type of dough hook or other agitator affects mixing speeds. Consult the manufacturer's specifications for whichever machine you use.
- Some lightweight machines are not powerful enough to mix a dough at medium speed for long periods. If this is the case, mix for twice the length of time in first speed to get the same gluten development.
- Times also depend on batch size. A small batch (for the size of the bowl) requires less time to incorporate the ingredients (dough formation) and less time for development.

Improved mix gluten window.

In the end, it is up to the baker to judge, by feel and by sight, when the dough has developed to the proper degree. Bakers make this judgment by making a *gluten window*, also called a windowpane test. Take a ball of developed dough and, using both hands, stretch it into a thin membrane. For the short mix, the gluten appears irregular and not well developed. For the improved mix, the gluten is somewhat more developed; and for the intensive mix, it is well developed and regular. Note that doughs containing whole-grain flours don't form gluten windows as easily because the particles of bran break or interfere with the gluten strands.

Intensive mix gluten window.

Dough Strength

The desired goal of gluten development is to achieve the proper dough strength. *Dough strength* can be described as the combination of three properties: extensibility, elasticity, and tenacity.

Extensibility is the ability of a dough to be stretched. An extensible dough is one that can be pulled into different shapes. A certain amount of extensibility is necessary for a dough to be made up into loaves or rolls.

Elasticity is the ability of a dough to spring back when it is stretched. For hearth breads, if a dough has extensibility but not enough elasticity, the loaves will flatten out rather than bake up high and round.

Tenacity refers to the resistance of a dough to being stretched. A dough with too much tenacity is difficult to work with during makeup. Laminated doughs that are too tenacious are difficult to roll out.

The baker must learn to judge dough strength by sight and feel in order to decide when the dough is properly developed and the mixing period is over.

In general, it is better to underdevelop a dough than to overdevelop. If the dough is undermixed, this can be largely corrected by giving additional folds during fermentation. On the other hand, if it is overmixed, it may be impossible to correct.

Matching the Technique to the Dough

What's the best mixing technique to use? In theory, any of the three techniques described can be used for any yeast dough product, depending on the results you want. For maximum flavor, you might think that the short mix is the best to use for all your products, but because of the long fermentation times, this approach would not fit most modern production schedules.

Perhaps the improved mix, then, is the best overall technique. Its production times are much shorter and it still yields products of good flavor and color. But you might want to make certain products—Pullman loaves for tea sandwiches, for example—that have the tight crumb structure that the intensive mix can best achieve. Or you may be able to make room in your production schedule for one or more flavorful short mix breads, such as an artisan baguette or sourdough.

In other words, it's difficult to say which is always the best mixing technique for a given formula. It depends on your needs and your schedule. You should think about the characteristics each mix achieves (see the Bread Characteristics Based on Mixing Technique table, below).

In the formulas in Chapter 8, we indicate which mixing technique to use. We selected these techniques in each case because they seem to be appropriate for the characteristics of that particular bread. But feel free to experiment with other mixing techniques to see how they alter the product.

BREAD CHARACTERISTICS BASED ON MIXING TECHNIQUE

MIXING TECHNIQUE	CRUMB COLOR	CRUMB STRUCTURE	FLAVOR AND AROMA
Short Mix	Creamy	Open, irregular	Complex
Improved Mix	Creamy white	Somewhat open and irregular	Good but mild; not as complex as short mix
Intensive Mix	White	Tight and regular	Bland

MIXING TIMES, FERMENTATION, AND FOLDS*

MIX TECHNIQUE	FIRST SPEED	SECOND SPEED	FERMENTATION TIME	FOLDS
Short Mix	10–11 minutes (4–5 minutes for dough formation; 6 minutes for development)	0	4–5 hours for straight doughs; 3–4 hours for doughs with sponge or pre-ferment	4–5
Improved Mix	4–5 minutes	5 minutes	1–2 hours	1–2
Intensive Mix	4–5 minutes	8–15 minutes	20–30 minutes	0

*Mixing and fermentation times are for a full batch in a standard planetary mixer, and are approximate. Adjust times as necessary (see p. 111). When using a lightweight machine not strong enough to mix a dough at second speed, use first speed and double the mixing time.

Bulk Fermentation

Fermentation is the process by which yeast acts on the sugars and starches in the dough to produce carbon dioxide gas (CO_2) and alcohol. The action of the yeast is described in Chapter 4 (pp. 79–80).

As we discussed earlier, gluten development continues during bulk fermentation. Gluten becomes smoother and more elastic as the dough ferments. For short mix doughs, a fermentation of 3 to 5 hours is required in order to develop the gluten, because it was underdeveloped during mixing. At the opposite extreme, an intensive mix dough needs only about 20 to 30 minutes of bulk fermentation—little more than a bench rest. If it is fermented too long, the dough becomes overdeveloped.

During bulk fermentation, the dough may be folded one or more times, as described in the next section. Folding is an important part of dough development and should be done carefully. In general, the longer the fermentation, the more folds required.

An underfermented dough will not develop proper volume, and the texture of the product will be coarse. An overfermented dough becomes too strong and hard to shape into loaves. If it is fermented far too long, excess acidity forms, making the dough sticky and hard to work. An underfermented dough is called a *young dough*. An overfermented dough is called an *old dough*.

Doughs with weak gluten, such as rye doughs and rich doughs, are usually underfermented, or "taken to the bench young."

At the end of the fermentation time, the dough is mature and ready for dividing and makeup. Through experience, a baker learns to judge dough maturity by feel.

Yeast action continues until the yeast cells are killed, when the temperature of the dough reaches 140°F (60°C) in the oven. It is important to be aware that fermentation continues during the next steps in yeast dough production—folding, dividing, preshaping, benching, and makeup or molding. *Failure to allow for this time may result in overfermented doughs*. Doughs that are to be made into rolls and loaves requiring a great deal of makeup time should be slightly underfermented to prevent the dough from being too old by the time makeup is complete.

More detailed information on dough making and on controlling fermentation is given in the sections beginning on page 120.

PROCEDURE: Fermenting Yeast Dough

Place the dough in a container large enough to allow for expansion of the dough. Cover the container and let the dough rise at a temperature of about 80°F (27°C) or at the temperature indicated in the specific formula. Ideally, the fermentation temperature is the same as the temperature of the dough when it is taken from the mixer. Fermentation should be in an environment of high humidity, or the fermenting dough should be kept covered to avoid drying or crusting.

If properly covered containers are not available, or if humidity is too low to prevent a crust from forming on the dough, you may oil the surface of the dough lightly. (Note: This is not recommended for doughs containing no fat).

Also note that fermentation times indicated in the Mixing Times, Fermentation, and Folds table on page 112, and in formulas, are general guidelines only. Fermentation is complete when the dough has had the proper number of folds and has approximately doubled in volume.

Folding

During fermentation, the dough rises, or increases in bulk. When the dough has approximately doubled in bulk, it is folded, as described in the Procedure for Folding Dough, which follows. There are three main benefits of folding:

- It expels carbon dioxide. This benefits yeast growth, because yeast activity slows down when its environment contains too much carbon dioxide.
- It helps develop gluten structure. The folding process realigns the gluten strands using a technique similar to the action of kneading or mixing.
- It equalizes the temperature throughout the dough.

Folding should not be done until the dough has expanded in bulk and the gluten is well relaxed and easy to stretch (extensible). If the gluten is still tight, attempting to stretch and fold the dough can harm the gluten structure.

In recipes for home use, folding is usually called *punching*. Some bakers dislike this term, however, because it is misleading, suggesting that the process involves simply hitting the dough with the fist. This is not the case. As just noted, the purpose of folding is not only to deflate the dough but to help develop gluten structure. This cannot be accomplished simply by "punching" the dough.

Large quantities of dough are more easily folded on a workbench, although small batches can easily be folded in the bowl or container in which they are fermented. Both methods are described in the Procedure for Folding Dough.

After folding, if more bulk fermentation is needed, return the dough to the fermentation container. If fermentation is complete, bring the dough to the workbench to prepare for the next step: dividing.

PROCEDURE: Folding Dough

METHOD 1: ON WORKBENCH

1. Dust the workbench with flour and turn out the fermented dough onto the bench so the top side is down.
2. Grasp the dough on one side, pull up (a), and fold over the center so about one-third of the dough mass is folded over.


A

3. Press down on the folded portion to expel gases (b).


B

4. Brush dusting flour from the top of the dough (c) so it doesn't become folded into the dough, which would make streaks in the finished bread.


C

5. Repeat steps 2 through 4 on the opposite side of the dough (d).


D

6. Repeat steps 2 through 4 on the remaining two sides of the dough.
7. Turn the dough over so the seams are on the bottom. Lift the dough and return it to the dough container.

METHOD 2: IN THE DOUGH CONTAINER

1. Pull up the dough on one side, fold it over the center, and press down.
2. Repeat on the remaining three sides of the dough.
3. Turn the dough upside down in the container.

KEY POINTS TO REVIEW

- What are the three basic techniques for mixing and fermenting yeast doughs? Describe each.
- What do the following terms mean: *extensibility, elasticity,* and *tenacity*?
- Describe the procedure for fermenting yeast doughs.
- What are the purposes of folding? How is it done?

Dividing (Scaling or Portioning Dough)

Using a baker's scale, divide the dough into pieces of the same weight, according to the product being made. In other words, there are two phases to this stage of bread production:

1. Cutting the dough into pieces.
2. Scaling the pieces to check and adjust their weight.

Try to cut the dough into pieces as close as possible to the desired weight. After cutting and scaling the first few pieces, you should be able to estimate the correct size to within an ounce or two. When each piece is scaled, adjust the weight as needed by adding or removing a small piece of dough.

During scaling, allowance is made for weight loss due to evaporation of moisture in the oven. This weight loss is approximately 10 to 13% of the weight of the dough. Allow an extra 1½ to 2 ounces dough for each 1 pound of baked bread, or 50 to 65 grams per 500 grams.

Actual baking loss depends on baking time, size of the unit, and whether it is baked in a pan or freestanding.

If a dough divider is used to make rolls, the dough is scaled into presses, which are then divided into 36 equal pieces (see pp. 44–45). For example, if 1⅓-ounce rolls are desired, the presses should be scaled at 3 pounds (36 × 1⅓ oz), plus 6 ounces to allow for baking loss. Presses are rounded, relaxed, and divided; the divided units may or may not be rounded again, depending on the product.

GUIDELINES: Dividing Yeast Dough

1. Dust the workbench with enough flour to keep the dough from sticking, but use no more dusting flour than necessary. A stiff dough such as bagel dough may need no dusting flour at all.
2. Handle the dough gently. Rough handling and excessive cutting can damage gluten structure.
3. Do not cut the dough in many small pieces and pile them on the scale. This does great damage to the gluten structure. The goal is to get as close as possible to the desired weight with one cut. Then make a small adjustment as necessary.
4. The most effective way to divide dough efficiently and accurately is to first cut it into long strips, about 4 to 5 inches (10 to 13 cm) wide (depending on the weight of the loaves you are making. Then divide these strips into rectangles of the correct weight.
5. Divide and scale the dough rapidly and efficiently to avoid overfermenting the dough.

Preshaping or Rounding

After scaling, the pieces of dough are preshaped. The goal is to form the dough into a fairly smooth, regular piece that, after resting, can easily be made into the final shape.

Many bakers preshape all their dough into smooth, round balls. This process is called *rounding*. Rounding forms a kind of skin by stretching the gluten on the outside of the dough into a smooth layer. This skin gives the dough a uniform shape and helps retain gases produced by the yeast.

Although it is possible to shape nearly any kind of loaf from a rounded dough, many bakers prefer to preshape the dough pieces into forms that are closer to their final shape. Thus, for long loaves such as baguettes, the dough is preshaped into a cylinder. Final shaping then requires less handling of the dough.

As in fermentation, folding, and dividing, handle the dough during shaping so as to not damage its structure. In the case of breads that have an open crumb structure, do not compress the dough too much. Handle it gently. On the other hand, for breads that need a tight crumb, such as Pullman loaves and bagels, handle the dough more vigorously to eliminate any large holes.

Also, evaluate the strength of the dough before preshaping and handle it accordingly. If the dough is very extensible (stretchable), give it a tighter preshaping. If it resists stretching, give it a loose preshaping so that the gluten is not too strong for final makeup.

A Procedure for Preshaping Large Rounds and a Procedure for Preshaping Oblongs or Cylinders follow. For rounding small rolls, use the technique for making up round rolls described in Chapter 8 (p. 171).

PROCEDURE: Preshaping Large Rounds

1. Place the cut, scaled dough on the workbench. Fold in half by folding the top edge down to the bottom edge. Seal the seam by pressing with the palm of the hand.
2. Turn the dough 90 degrees, so that the bottom edge is now at the side.
3. Again fold in half by folding the top edge down to the bottom edge and sealing with the palm of the hand.
4. Turn the dough so that the seam is on the bottom. Cup your hands around the dough and roll the dough in a tight circle on the workbench to even out the shape.

PROCEDURE: Preshaping Oblongs or Cylinders

1. Place the cut, scaled dough on the workbench so that a long side is parallel with the edge of the bench.
2. Grasp the two sides of the dough and stretch it gently into a rough rectangle.
3. Fold the right and left sides of the rectangle toward the center. Press with the palm of the hand to seal.
4. Fold the top edge of the dough down to the bottom edge and seal.
5. Roll the dough under the palms of the hands to shape a cylinder.

Bench-Proofing or Intermediate Proofing

Rounded or preshaped portions of dough are allowed to rest for 10 to 20 minutes. This relaxes the gluten to make final shaping of the dough easier. Also, fermentation continues during this time.

In large operations, the rounded dough is placed in special proofers for this rest. Smaller operations place the dough in boxes that are stacked on one another to keep the dough covered. Or the dough may simply be placed on the workbench and covered—hence the term *benching* or bench rest.

Makeup and Panning

The dough is shaped into loaves or rolls and then placed in pans or on baking sheets. *Hearth breads*—breads baked directly on the bottom of the oven—may be placed in floured baskets or other molds after makeup.

Proper makeup or molding is of critical importance to the finished baked product. If a tight crumb is desired, all gas bubbles should be expelled during molding. Bubbles left in the dough will result in large air holes in the baked product. By contrast, breads with an open crumb should be molded more gently to preserve the air holes.

For both pan breads and hearth breads, the seam must be centered on the bottom to avoid splitting during baking. For units baked in pans, the pan size must be matched to the weight of the dough. Too little or too much dough will result in a poorly shaped loaf.

Breads and rolls take a great many forms. Many shapes and techniques are presented in Chapters 8 and 9.

Proofing

Proofing is a continuation of the process of yeast fermentation that increases the volume of the shaped dough. Bakers use two terms so they can distinguish between fermentation of the mixed dough and proofing of the made-up product before baking. Proofing temperatures are generally higher than fermentation temperatures.

Underproofing results in poor volume and dense texture. Overproofing results in coarse texture and some loss of flavor.

For short mix doughs, final proofing time is relatively short—up to 1 hour, on average—because the gluten is not as well developed and therefore will not hold as much gas. Proofing for improved and intensive mix doughs generally takes 1 to 2 hours. For breads leavened only by sourdough starter and no commercial yeast (see Chapter 7), proofing takes even longer.

Rich doughs are slightly underproofed because their weaker gluten structure does not withstand too much stretching.

PROCEDURE: Proofing Yeast Dough Items

1. For lean yeast doughs, place the made-up products in a proof box at 80° to 85°F (27° to 30°C) and 70 to 80% humidity, or as indicated in the formula. Proof until double in bulk.
   - Rich doughs, especially rolled-in doughs, are usually proofed at a lower temperature (77°F or 25°C) so the butter does not melt out of the dough.
   - Avoid using too much humidity. This weakens the surface of the dough and causes uneven proofing.
   - If a proof box is not available, come as close to these conditions as you can by covering the products to retain moisture and setting them in a warm place.
2. Test proof by sight (the unit doubles in bulk) and by touch. When touched lightly, properly proofed dough springs back slowly. If it is still firm and elastic, it needs more proofing. If the dent remains in the dough, the dough is probably overproofed.

Baking

Recall from Chapter 5 that many changes take place in the dough during baking. If necessary, review pages 100–102. The most important changes are:

- *Oven spring*, also called oven kick, which is the rapid rising in the oven due to production and expansion of trapped gases as a result of the oven heat. The yeast is very active at first but is killed when the temperature inside the dough reaches 140°F (60°C).
- Coagulation of proteins and gelatinization of starches. In other words, the product becomes firm and holds its shape.
- Formation and browning of the crust.

To control the baking process, consider the factors described next.

Oven Temperature and Baking Time

Temperatures must be adjusted for the product being baked. At the proper temperature, the inside of the unit becomes completely baked at the same time the crust achieves the desired color. Therefore:

1. Large units are baked at a lower temperature and for a longer time than small rolls spaced apart.
2. Rich doughs and sweet doughs are baked at a lower temperature because their fat, sugar, and milk content makes them brown faster.
3. French breads made with no added sugar and a long fermentation require very high temperatures to achieve the desired crust color.

Note the following specific temperatures:

- Popular American lean breads are baked at 400° to 425°F (205° to 220°C).
- Some French breads are baked at 425° to 475°F (220° to 245°C).
- Rich products are baked at 350° to 400°F (175° to 205°C).

A golden-brown crust color is the normal indicator of doneness. Loaves that are done sound hollow when thumped.

Washes

Many, if not most, yeast products are brushed with a liquid, called a ***wash***, just before baking. The most common washes are as follows:

- *Water* is used primarily for hard-crusted products, such as French bread. Like steam in the oven (see below), the water helps keep the crust from drying too quickly and thus becoming too thick.
- *Starch paste* is used primarily for rye breads. In addition to keeping the crust from drying too quickly, the starch paste helps give a shine to the crust.
  To make a starch paste, mix 1 ounce light rye flour with 1 quart water (60 g rye per 500 mL water). Bring to a boil while stirring. Cool. If necessary, thin with water to the consistency of cream.
- *Egg wash* is used to give a shiny brown crust to soft breads and rolls and to rich doughs and Danish. It is made by mixing beaten eggs with water or, sometimes, milk. Proportions vary greatly depending on how strong a wash is desired.
- *Commercial aerosol washes (sprays)* provide a quick and easy way to give shine and to help toppings such as seeds adhere.

Scoring baguettes.

Photo taken at Turtle Bread Company.

Scoring

A break on the side of the loaf is caused by continued rising after the crust is formed. To allow for this expansion, the tops of hard-crusted breads are cut just before baking. Properly scored loaves expand better in the oven and attain greater volume and have a more open crumb structure.

Slashes are made on the top of the loaf with a baker's lame (pronounced lahm; French for "blade," a curved or straight razor blade attached to a handle) or other sharp knife or razor immediately before it is put into the oven, as shown in the photograph. The pattern created by the cuts also contributes to the appearance of the bread.

Follow these scoring guidelines:

- If the loaves seem somewhat overproofed, or if the gluten is weak, make only shallow cuts to prevent deflating the loaves. Underproofed loaves can be scored more deeply.
- Small rolls usually bake completely without a break, so they are usually not scored unless desired for the sake of appearance.
- Loaves baked in pans are usually not scored, because the pan enables the bread to expand without rupturing.

Baker's lames.

Removing baguettes from an oven.

Photo taken at Turtle Bread Company.

Loading the Ovens

Proofed doughs are fragile until they become set by baking. Therefore, handle them carefully when loading them into the ovens, and do not disturb them during the first part of baking.

Breads and rolls are baked either directly on the bottom of the oven (hearth breads) or in pans.

- **Hearth breads.** To load the ovens, place the proofed units on a peel that is well dusted with cornmeal. Slide the peel into the oven. Then, with a quick snap, remove the peel, leaving the loaves or rolls in place. To remove baked items, quickly slide the peel under them and pull them out. The illustration shows a peel in use.

- **Pan breads and rolls.** Freestanding items may be baked on sheet pans instead of on the hearth. Bakers generally refer to such breads and rolls as ***hearth breads*** even if they are not baked directly on the bottom of the oven. Sprinkle the pans with cornmeal to keep the units from sticking, and to simulate the appearance of hearth-baked items. Pans may also be lined with silicone paper. Perforated sheet pans or screens are also available. These allow better air circulation and therefore permit more even browning.

  Sandwich loaves and other pan breads are, of course, baked in loaf pans or other appropriate pans. Details are given in the makeup section of Chapter 8.

Steam

Hard-crusted breads are baked with steam injected into the ovens during the first part of the baking period. Rye breads also benefit from baking with steam for the first 10 minutes.

The steam helps keep the crust soft during the first part of baking so the bread can expand rapidly and evenly without cracking or breaking. If steam were not used, the crust would begin forming earlier and thus would become thick and heavy. Crust that forms too early is likely to split as the interior continues to expand.

The steam also helps distribute the heat in the oven, further aiding oven spring. When the moisture of the steam reacts with the starches on the surface, some of the starches form dextrins. Then, when the steam is withdrawn, these dextrins, along with sugars in the dough, caramelize and turn brown. The result is a thin, crisp, glazed crust.

Rich doughs, those with higher fat or sugar content, do not form crisp crusts and are usually baked without steam.

Cooling

After baking, bread must be removed from the pans and cooled on racks to allow the escape of the excess moisture and alcohol created during fermentation.

Small rolls spaced on baking sheets are often cooled on the pans when air circulation is adequate. On the other hand, if condensation is likely to make the bottoms of the rolls soggy, it is better to cool them on racks.

If soft crusts are desired, breads may be brushed with melted shortening before cooling.

Do not cool bread in a draft because the crust may crack.

Like other dough products, breads continue to undergo physical and chemical changes after they are removed from the oven. Review page 102 for a summary of these changes.

Storing

Breads to be served within eight hours may be left on racks. For longer storage, wrap cooled breads in moistureproof bags to retard staling. Note, however, that bread must be thoroughly cool before wrapping, or moisture will collect inside the bags.

Wrapping and freezing maintains quality for longer periods. Refrigeration, on the other hand, increases staling.

Hard-crusted breads should not be wrapped (unless frozen) because the crusts will soften and become leathery. Alternatively, use porous bags or wrapping material that protects the bread from contamination but allows moisture to escape.

KEY POINTS TO REVIEW

- What are five guidelines for dividing dough?
- How and why is dough preshaped?
- What is the procedure for proofing yeast dough items?
- What factors should be considered when determining baking temperature?
- When is steam used in baking? Why?

TYPES OF DOUGH-MAKING PROCESSES

Straight Dough

In the typical small retail shop, most breads are mixed by the straight dough method—that is, all ingredients are mixed in one operation, as described on page 108. The dough is then given a short bulk fermentation time and is divided, rounded, molded, and ready for proofing only 1 to 2½ hours after leaving the mixer. This is called a *short-fermentation straight dough*.

A *no-time dough* is made with a large quantity of yeast, preferably instant dry yeast, taken from the mixer at a higher temperature (up to 90°F/32°C) and given only a few minutes' rest before being scaled and made up. It is also given a shorter proof. This process should be used only in emergencies because the final product does not have a good texture and flavor.

Long-fermentation doughs are mixed using the short mix technique and are fermented for 4 or 5 hours or longer, often at a temperature of 75°F (24°C) or lower. During this time, the dough is folded several times. The advantage of this method is that the long, slow fermentation greatly enhances the flavor of the product. Some of the best European breads are made this way. The major disadvantage—besides a more demanding work schedule—is that the fermentation is harder to control because of fluctuations in temperature and other factors. Doughs often become overfermented. In spite of this, long fermentation has been revived with the growing interest in artisan breads (see Chapter 7).

To avoid the problems of a long-fermentation straight dough but achieve some of the flavor created by a long fermentation, one can use the sponge method.

Sponge Processes

The sponge process involves a two-stage mixing method, as described on page 109. First, a sponge is made of water, flour, and yeast and allowed to ferment. Then the dough is made by mixing in the remaining ingredients. The finished dough may be given a short fermentation, or, if the sponge has had a long fermentation, it may be scaled immediately, like a no-time dough.

There are a number of advantages of the sponge method:

- Shorter fermentation time for the finished dough.
- Scheduling flexibility. Sponges can usually be held longer than finished dough.
- Increased flavor, developed by the long fermentation of the sponge.
- Stronger fermentation of rich doughs. High sugar and fat content inhibits yeast growth. When the sponge method is used, most of the fermentation is complete before the fat and sugar are incorporated.
- Less yeast is needed, because it multiplies during the sponge fermentation.

CONTROLLING FERMENTATION

PROPER FERMENTATION—THAT is, fermentation that produces a dough that is neither underripe (young) nor overripe (old)—requires a balance of time, temperature, and yeast quantity.

Time

Fermentation times vary, so the time to punch the dough is indicated not by clock but by the appearance and feel of the dough. Thus, the fermentation times given in the formulas in this book should be regarded as guidelines only.

To vary the fermentation time, you must control the dough temperature and the amount of yeast.

Temperature

Ideally, dough is fermented at the temperature at which it is taken from the mixer. Large bakeries have special fermentation rooms for controlling temperature and humidity, but small bakeshops and restaurant kitchens seldom have this luxury. If a short-fermentation process is used, however, the fermentation is complete before the dough is greatly affected by changes in shop temperature.

Water Temperature

Dough must be at the proper temperature, usually 78° to 80°F (25.5° to 26.7°C), in order to ferment at the desired rate. The temperature of the dough is affected by several factors:

- Shop temperature
- Flour temperature
- Water temperature
- Friction caused by mixing

Of these, water temperature is the easiest to control in the small bakeshop. Therefore, when the water is scaled, it should be brought to the required temperature. On cold days, it may have to be warmed, and on hot days, using a mixture of crushed ice and water may be necessary. Also, if a long fermentation is used, the dough temperature must be reduced in order to avoid overfermenting.

Friction caused by mixing warms the dough. This machine friction factor varies, depending on the type of mixer, the size of the batch, and the type of dough. This means that, to be accurate in a regular production situation, you need to calculate the machine friction for each dough you produce. Appendix 5 (page 744) explains the procedure for making this calculation. In a learning situation, you can use an average number as explained in the Procedure for Determining Water Temperature.

PROCEDURE: Determining Water Temperature

1. Multiply the desired dough temperature by 3.
2. Add together the flour temperature and room temperature, plus 20°F (11°C) to allow for the friction caused by mixing (see *Note*).
3. Subtract the result of step 2 from that of step 1. The difference is the required water temperature.

Example: Dough temperature needed = 80°F
Flour temperature = 68°F
Room temperature = 72°F
Machine friction = 20°F
Water temperature = ?

1. 80° × 3 = 240°
2. 68° + 72° + 20° = 160°
3. 240° − 160° = 80°

Therefore, the water temperature should be 80°F.

Note: This procedure is precise enough for most purposes in the small bakeshop. However, there are other complications, such as variations in machine friction, that you may want to consider if you wish to be even more exact. To learn how to make these calculations, see Appendix 5.

PROCEDURE: Modifying Yeast Quantities

1. Determine a factor by dividing the old fermentation time by the fermentation time desired.
2. Multiply this factor by the original quantity of yeast to determine the new quantity.

$$\frac{\text{Old fermentation time}}{\text{New fermentation time}} \times \text{Old yeast quantity} = \text{New yeast quantity}$$

Example: A formula requiring 12 oz yeast has a fermentation time of 2 hours at 80°F. How much yeast is needed to reduce the fermentation time to 1½ hours?

$$\frac{2 \text{ hours}}{1\frac{1}{2} \text{ hours}} \times 12 \text{ oz yeast} = 16 \text{ oz yeast}$$

Caution: This procedure should be used within narrow limits only. An excessive increase or decrease in yeast quantities introduces many other problems, and results in inferior products.

Yeast Quantity

If other conditions are constant, the fermentation time may be increased or decreased by decreasing or increasing the quantity of yeast (see Procedure for Modifying Yeast Quantities). In general, use no more yeast than is needed. Excessive yeast results in inferior flavor.

Small Batches

When very small quantities of dough—only a few pounds—are made, the dough is more likely to be affected by shop temperature. Thus, it may be necessary to slightly increase the yeast quantity in cool weather and slightly decrease it in hot weather.

Other Factors

The salt in the formula, the minerals in the water, and the use of dough conditioners or improvers affect the rate of fermentation. See page 90 for a discussion of salt and its effect on fermentation.

Water that is excessively soft lacks the minerals that ensure proper gluten development and dough fermentation. On the other hand, water that is very hard—that has high mineral content and, as a result, is alkaline—also inhibits the development of the dough. These conditions are more of a problem for lean doughs than for rich doughs. In most localities, small bakeshops can overcome these problems with the proper use of salt or, in areas with alkaline water, by adding a very small amount of a mild acid to the water. Dough conditioners, buffers, and improvers that can correct these conditions are available from bakers' suppliers. Their use should be determined by local water conditions.

The richness of the dough must also be considered. Doughs high in fat or sugar ferment more slowly than lean doughs. This problem can be avoided by using a sponge instead of a straight dough.

Retarding

Retarding means slowing the fermentation or proof of yeast doughs by refrigeration. This may be done in regular refrigerators or in special retarders that maintain a high humidity. If regular refrigerators are used, the product must be covered to prevent drying and the formation of a skin.

Retarded Fermentation

Dough to be retarded in bulk is usually given partial fermentation. It is then flattened on sheet pans, covered with plastic wrap, and placed in the retarder. The layer of dough must not be too thick because the inside will take too long to chill and thus will overferment. When needed, the dough is allowed to warm before molding. Some doughs high in fat are made up while chilled so they do not become too soft.

Retarded Proof

Made-up units to be retarded are made from young dough. After makeup, they are immediately placed in the retarder. When needed, they are allowed to warm and finish their proof, if necessary. They are then baked.

A valuable laborsaving tool for medium to large bakeshops is the *retarder-proofer*. As the name suggests, this equipment is a combination of freezer/retarder and proofer, with thermostats for both functions and with timers to automate the process. For example, the baker can make up a batch of rolls in the afternoon or evening and place them in the retarder-proofer with the controls set for retarding or freezing. The baker sets the timer for the proper hour the following morning. The machine automatically begins to raise the temperature, proofing the rolls so they are ready to bake in time for breakfast.

BREAD FAULTS AND THEIR CAUSES

BECAUSE OF THE complexity of bread production, many things can go wrong. To remedy common bread faults, check the following troubleshooting guide for possible causes and correct your procedures accordingly.

Fault	Causes
SHAPE	
Poor volume	Too much salt Too little yeast Too little liquid Weak flour Under- or overmixing Oven too hot
Too much volume	Too little salt Too much yeast Too much dough scaled Overproofed
Poor shape	Too much liquid Flour too weak Improper molding or makeup Improper fermentation or proofing Too much oven steam
Split or burst crust	Overmixing Underfermented dough Improper molding—seam not on bottom Uneven heat in oven Oven too hot Insufficient steam
FLAVOR	
Flat taste	Too little salt
Poor flavor	Inferior, spoiled, or rancid ingredients Poor bakeshop sanitation Under- or overfermented

Fault	Causes
TEXTURE AND CRUMB	
Too dense or close-grained	Too much salt Too little liquid Too little yeast Underfermented Underproofed
Too coarse or open	Too much yeast Too much liquid Incorrect mixing time Improper fermentation Overproofed Pan too large
Streaked crumb	Improper mixing procedure Poor molding or makeup techniques Too much flour used for dusting
Poor texture or Crumbly	Flour too weak Too little salt Fermentation time too long or too short Overproofed Baking temperature too low
Gray crumb	Fermentation time or temperature too high
CRUST	
Too dark	Too much sugar or milk Underfermented dough Oven temperature too high Baking time too long Insufficient steam at beginning of baking
Too pale	Too little sugar or milk Overfermented dough Overproofed Oven temperature too low Baking time too short Too much steam in oven
Too thick	Too little sugar or fat Improper fermentation Baked too long or at wrong temperature Too little steam
Blisters on crust	Too much liquid Improper fermentation Improper shaping of loaf

KEY POINTS TO REVIEW

- What are the advantages of the sponge method?
- What are the three main factors that determine proper fermentation of a yeast dough?
- What procedure is used to control the final temperature of a dough as it comes from the mixer?

TERMS FOR REVIEW

lean dough
rich dough
rolled-in dough
laminated dough
pickup stage
cleanup stage
initial development phase
final development phase
straight dough method
sponge
yeast starter
yeast pre-ferment
sponge method
short mix
improved mix
intensive mix
gluten window
dough strength
extensibility
elasticity
tenacity
fermentation
young dough
old dough
punching
rounding
benching
hearth bread
proofing
oven spring
wash
short-fermentation straight dough
no-time dough
long-fermentation dough
retarding
retarder-proofer

QUESTIONS FOR DISCUSSION

1. What are the main differences in ingredients between French bread and white sandwich bread?
2. Why is Danish pastry dough flaky?
3. What are the 12 steps in the production of yeast products? Explain each briefly.
4. What are the three major purposes of mixing yeast doughs?
5. Explain the differences in procedure between the straight dough method and the sponge method. How is the straight dough method sometimes modified for sweet doughs, and why is this necessary?
6. Explain the differences between the short mix technique, the improved mix technique, and the intensive mix technique.
7. What are the purposes of folding a fermented dough?
8. How much French bread dough will you need if you want to make 16 loaves that weigh 12 ounces each after baking?
9. List five advantages of the sponge method for mixing bread doughs.
10. What is the importance of water temperature in mixing yeast doughs?