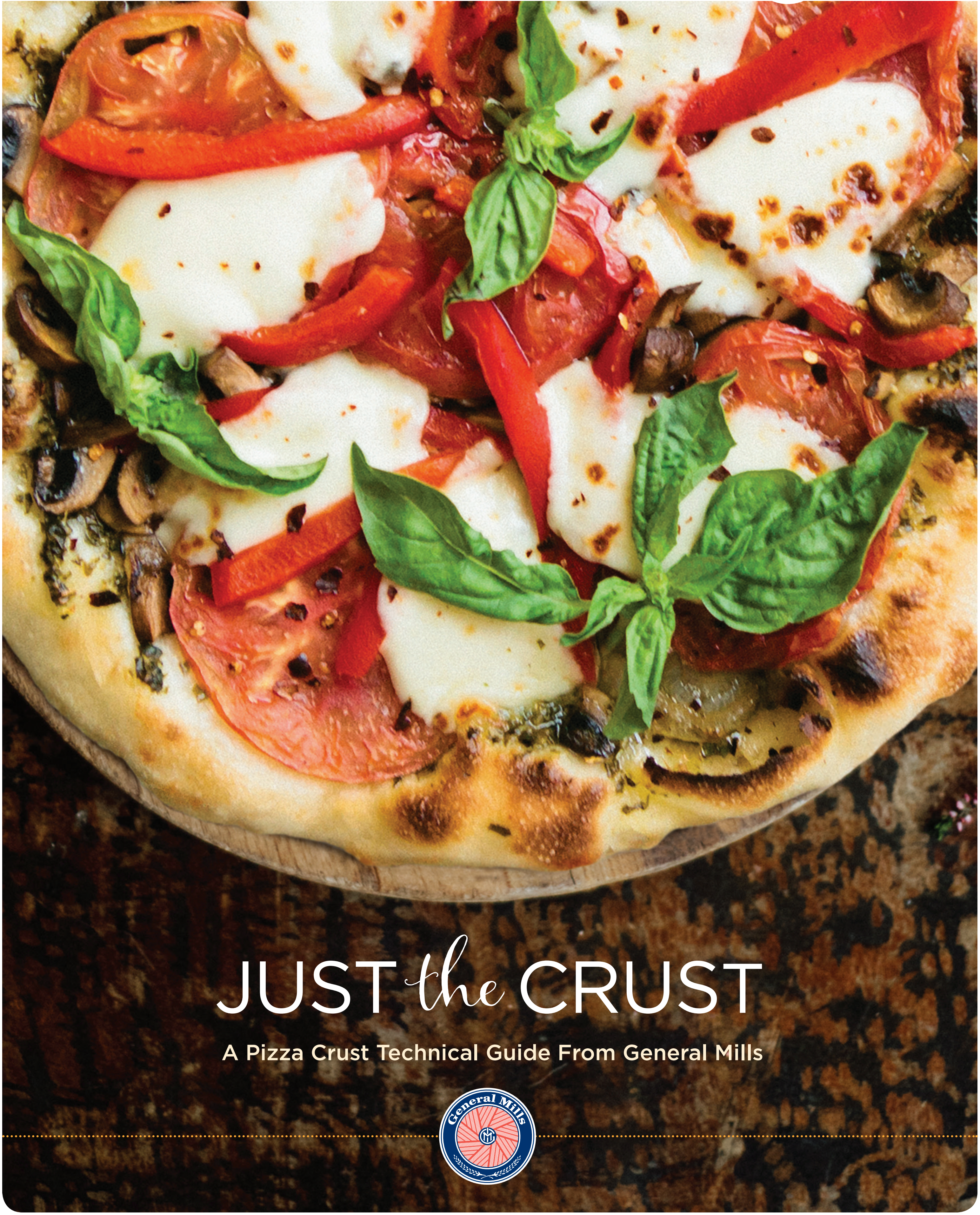
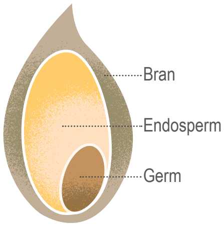
GENERAL MILLS
Foodservice



JUST the CRUST

A Pizza Crust Technical Guide From General Mills

CRUSTS MADE FROM SCRATCH MAKE ALL THE DIFFERENCE



The WHEAT KERNEL

A scratch-made crust is the key to a successful pizza operation. For pizza operators like you, it represents your personal signature and creates a lasting impression with your customers. The question is, where do you begin? With 4 simple ingredients: flour, water, yeast, and salt. These are the building blocks to a basic crust. To make it your own, you can consider adding one or more optional ingredients: sugar, shortening, oil, specialty flours, spices or flavorings. This guide will help you better understand the ingredients, the process and the technique of making a pizza crust you can be proud to call your own.

Flour

Flour is the most important ingredient in pizza crust, so let's start here. When we talk flour, we are talking wheat flour. Why? Wheat is the most commonly distributed cereal grain in the world. Therefore, a reference to flour is generally a reference to wheat flour. Just as flour is not "just flour," wheat is not "just wheat."

From Wheat to Flour

Wheat is classified into three categories:

1. **Growing season:** winter or spring
2. **Bran color:** red or white
3. **Kernel hardness**: hard or soft

Growing Season

There are two distinct growing seasons for wheat: winter and spring.

- **Winter wheat** is grown in regions where the winters are mild and dry. The wheat is planted in the fall, lies dormant during the winter months and is harvested during late spring to early summer.
- **Spring wheat** is planted in the spring and harvested during late summer. The production of spring wheat is concentrated in the northern Great Plains states where the winters are too cold for winter wheat to survive.

Bran Color

The bran is the outer protective coating of the wheat kernel. Wheat can be classified as either red or white.

Kernel Hardness

Wheat kernels are either hard or soft. This wheat characteristic has the greatest impact on the baking qualities of the flour produced.

- **Soft wheat flours** are used for chemically leavened goods and hard wheat flours are used in yeast-raised goods.
- **Hard wheat flour** has a higher protein content and stronger gluten-forming proteins than soft wheat. Why is this important? Gluten is the basic structure in the dough that provides extensibility and elasticity. These characteristics are directly related to the overall appearance and texture of the crust.

GENERAL MILLS BRANDS PROTEIN CONTENT

% PROTEIN	EASTERN	WESTERN
10-11	GOLD MEDAL HOTEL & RESTAURANT	GOLD MEDAL HOTEL & RESTAURANT
11-12	- KING WHEAT - NEAPOLITAN	- BIG LOAF - HARVEST KING
12-13	- FULL STRENGTH - SUPERLATIVE	- FULL STRENGTH - SUPERLATIVE
13-14	- REMARKABLE - ALL TRUMPS	- SUPREME HY GLUTEN - ALL TRUMPS - KING KAISER

CHICAGO DEEP DISH: 10-12% PROTEIN

In general, the thinner the pizza crust, the more protein needed.

NEW YORK THIN CRUST: 13-14% PROTEIN

As a rule, pizza operators purchase flour in three specific ranges of protein: 10 to 12%, 12 to 13%, and 13 to 14%. In general terms, the thinner the pizza crust, the more protein needed. So a Chicago-style deep dish would have 10 to 12% protein while a New York style thin crust would have 13 to 14% protein. Everything else falls somewhere in between. The General Mills brands that meet these protein requirements are noted in the chart (at left).

FUNCTIONALITY OF INGREDIENTS

The
BAKER'S
%

Ingredients are often expressed as a percentage of the total flour weight — the baker's percent method.

Flour

Flour provides the structure in the dough. The gluten-forming proteins in the flour allow the dough to rise during fermentation (extensibility) and maintain its volume and shape during and after baking (elasticity). Because the amount of gluten-forming proteins are associated with the protein content of the flour, an adjustment in the protein level of the flour will affect functionality. Higher protein will make firmer, stronger dough while lower protein will make softer, weaker dough. Because flour plays the leading role in dough formulas, most pizza operators express their formulations based on flour percentage. All ingredients are expressed as a percentage of the total flour weight in the formula. This is referred to as the baker's percent method. As an example, if the formula requires 50 pounds of flour and 25 pounds of water, as a baker's percent this would be expressed as:

INGREDIENT	WEIGHT	BAKER'S %
Flour	50	100
Water	25	50

The water is 50% of the flour weight (50 lb. x 0.50) = 25 lb. With this method, the flour percentage is always 100%. All the references regarding ingredients are expressed in percentages as related to the weight of the flour.

Water

Water provides hydration of the dry ingredients. It acts as a solvent for the minor ingredients like salt and sugar. Most importantly, the water combines the gluten-forming proteins in the flour, gliadin and glutenin to form gluten structure of the dough. The quantity of water will affect the consistency of the dough. Softer dough contains more water than stiff dough. Water quantities can range from 45-60% as compared to the weight of flour. Since water is the second largest ingredient by weight in the formulation, it has a large effect on the finished dough temperatures.

Yeast

Yeast functions to leaven (raise) the dough through the production of carbon dioxide gas. Other by-products of yeast fermentation include alcohol, acids, and heat, which all act to soften the gluten structure of the dough. These by-products also aid in the flavor development of the dough. Yeast usage levels range from 0.5-3% as compared to the weight of the flour. Pizza shops are using one of the following three yeast types: compressed (cake), active dry or instant dry. Each of these will produce a quality crust, but each is unique in how it is used in the dough making process.

DIFFERENCE BETWEEN YEAST TYPES

	COMPRESSED	ACTIVE	INSTANT
Usage	rehydrate (or dry)	rehydrate	dry
Storage	refrigerate	room temp	room temp
Shelf Life	4-6 weeks	2 years (sealed)	2 years (sealed)
Activity	medium	slow	fast
Substitution Rate	100%	66%	33%

*Substitution rates are based on a comparison to compressed as the standard

COMPRESSED YEAST

The "traditional" yeast of the baking industry, compressed yeast is also known by bakers as "fresh," "block," "cake" or even as "baker's yeast." Most formulations that call for yeast are actually references for compressed yeast. Compressed yeast is a high moisture (70%) product generally packaged in one pound blocks and has a shelf life of less than 30 days. Because of its high moisture content, refrigerated storage is required. Exposure to room temperatures will be detrimental to yeast activity. Fresh yeast should be brought out of the cooler just prior to use and then stored immediately thereafter. Pizza operators use fresh yeast in two different ways: directly into the flour or rehydrated in water.

ACTIVE DRY YEAST

This type of yeast must be rehydrated in 100-110°F water and allowed to set for 5-10 minutes.

INSTANT DRY YEAST

This yeast does not require rehydration and therefore is added directly to the dry mix. For an operator starting a pizza business today, we recommend instant dry yeast because it's easy-to-use and delivers consistent, high quality results. The chart to the left features the distinct differences between yeast types.

Salt

Flavor enhancement is the primary function of salt. Salt has the unique ability to bring out the other flavors in food. In addition, salt has two functional effects in the dough-making process. First, salt contributes to gluten strength, creating firmer dough. Second, salt levels above 1% affect the fermentation process. In general, a salt level of 1-2% as compared to flour weight is used.

Sugar

The most visible effect of sugar is crust browning. Browning is affected by the amount of residual sugars in dough. The more sugar in the dough, the greater the browning effect. The typical amount used in a formulation ranges between 2 and 4% compared to flour weight. Sugar has a tenderizing effect on crust by increasing the moisture retention of the dough. Sugar also plays an important role in yeast fermentation.

Pizza INGREDIENT HIGHLIGHTS

SALT
contributes to gluten strength, creating firmer dough.

SUGAR
affects crust browning.

OIL
makes dough easier to work with and helps control dough temperatures by limiting friction in the bowl.

Oil

Oil acts as a dough lubricant. Lubrication increases the extensibility of dough, making it easier to work with and shape. Oil assists in the control of dough temperatures by limiting friction in the bowl. The lubrication gives tenderness to the crust while providing a barrier between the sauce and crust. There is a wide range of usage quantities dependent upon the desired style of crust. A typical range is 3 to 7%. Lean formulas range from 1-4% compared to flour weight. Rich formulas range from 5-14%.

Non-Fat Dry Milk (NFDM)

NFDM can increase the crust browning on the finished crust. If an extra-brown crust is desired, adding 1-2% NFDM could do the trick. Also, because NFDM acts as a buffering agent, it can actually slow down the rate of fermentation, therefore increasing the tolerance for fermentation.

Spices & Flavorings

Spices and flavorings bring pizzazz to pizza crusts. Some popular choices include basil, oregano, parsley, rosemary, thyme, sage and peppers. Garlic and onion are flavorings that come naturally to pizza. They are often used as “background” flavor in crusts, which creates a good dough base for product extensions like breadsticks and focaccia. In addition, onion and garlic have a functional influence on dough strength by relaxing the gluten.

Specialty Flours

WHOLE WHEAT

Whole wheat flour is a natural choice for supplementing a regular white flour formula. The extra color, flavor and texture can be a real plus for your product. Rather than using all whole wheat flour, the best bet is to replace 20 to 40% of your white flour with whole wheat flour for a “wheat style” or “wheaten crust.” Whole wheat will generally take up more water and require less mix time. A dough with any proportion of whole wheat flour will be weaker and therefore less tolerant to mix and fermentation time.

Below are some key points to remember when incorporating whole wheat flour into your pizza dough formula:

Formula Adjustments

- Substitute 20 to 40% of your white flour with whole wheat flour
- Increase absorption (water) 0.5% – 1.5% for every 10% whole wheat flour added
- Often an increase in sweetener (honey is a great idea) is needed to balance the flavor
- Consider using a higher protein flour to support the whole wheat

Process Adjustments

- Less mix times due to bran protein dilution & gluten cutting
- Slower hydration rate of water with whole wheat flour
- Less fermentation due to weaker structure
- Dough will have a shorter shelf life

SEMOLINA

Semolina flour is the coarsely ground product of durum wheat primarily used in making pasta. It’s a great addition to dough when incorporated In the range of 10-30%. Semolina enhances the chewiness of the crust and develops a rich color. It also makes an excellent dusting flour.

Whole Wheat Flour

A dough made with whole wheat flour will be weaker and therefore less tolerant to mix & fermentation time.

DOUGH FORMULATIONS

As you develop your own signature crust, it's important to consider these basic dough formulations as your starting point. The following lists the typical ingredient percent in dough formulations expressed as a percent compared to the total flour weight.

PIZZA TYPE	NY THIN	PAN	DEEP DISH	CRACKER	NEAPOLITAN
Flour Protein Type	13-14%	12-13%	10-12%	10-12%	10-12%
Formula	%	%	%	%	%
Flour	100	100	100	100	100
Water	56	53	56	50	63
Salt	2	1.5	1.5	2	2.25
Sugar	1	2	2.5	4	0
Oil	4	6	8	2	0
Instant Yeast	0.75	1	0.5	1	0.25

Dough Make-up

To make good quality dough, there are three main steps to help you control your dough:

1. **Scaling the ingredients**
2. **Order of addition for the ingredients**
3. **Dough development**

First, scale the ingredients. Measuring an ingredient is based on "volume" while scaling is based on "weight." One of the easiest ways to eliminate variability in dough is to weigh the ingredients. A pound is a pound no matter who weighs it.

Once the ingredients are accurately weighed, combine them to form the dough. The order in which the ingredients are added to the bowl is another factor that ensures consistency. The suggested order is water, then dry ingredients, then delayed oil.

For example . . .

First, pour water into the bowl. Starting with water in the bowl ensures a quicker, cleaner and more efficient mixing action. Plus, the flour will hydrate quickly, which helps avoid having dry materials in the bowl's bottom at the end of mixing.

Note: if using active dry yeast, the yeast needs to rehydrate in water first. Only a portion of the water is needed for this process. Once rehydrated, the yeast solution can be added with the dry ingredients.

Second, place all dry ingredients including flour, salt, sugar and instant yeast on top of the water, then start the mixer. There's no need to pre-mix. Mix for about one minute to ensure all ingredients are uniformly blended. The key is to hydrate the dry ingredients with the water before adding any oil.

The SUGGESTED ORDER OF INGREDIENTS

1. WATER
2. DRY INGREDIENTS
3. OIL

After one minute, the flour and dry ingredients have absorbed all of the available water. Pause the mixer and add the oil. Restart the mixer as the dough starts to develop.

Dough development in the mixer is all about forming the gluten structure in the dough. Once hydrated by the water and placed under the mechanical action from the dough hook, the gluten-forming proteins found in the flour start to form a gluten network.

Initially, these protein strands form a very unorganized pattern. As the mixing action progresses, this pattern becomes more uniform. Dough development is all about finding a balance between extensibility (the stretch) and elasticity (the snap back).

It is important to recognize the stages of gluten development that occur in the mixing process. The next time you mix dough, pause the mixer every few minutes to feel the stages of dough development.

Dough development is all about finding a balance between extensibility (the stretch) and elasticity (the snap back).

FACTORS AFFECTING FERMENTATION

3

FACTORS AFFECTING RATE OF FERMENTATION

1. Amount of sugar
2. Amount of salt
3. Dough temperature

As noted earlier, the main function of yeast is leavening the dough. Carbon dioxide is produced as the yeast digests available sugars. This process of gas production is called fermentation. The rate at which fermentation occurs is mainly affected by three factors: the amount of sugar, the amount of salt, and dough temperature.

Sugar

Sugar is what yeast eats. There is a supply of simple sugars available in dough from the flour. Since yeast has a natural sweet tooth, added sugar speeds up fermentation. Sugar amounts, up to 5% of flour weight, will increase the rate of fermentation. Too much sugar can be a bad thing. Quantities above 5% sugar will slow down the rate of fermentation.

Salt

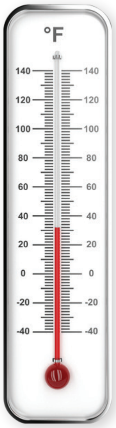
Salt has a controlling effect on the rate of fermentation. It will slow down the rate of fermentation at quantities between 1 to 2% of the total flour weight.

Dough Temperature

The factor that has the largest effect on the rate of yeast fermentation is dough temperature. For every 15°F increase in temperature up to 140°F, the rate of fermentation doubles. Yeast is most active at a comfortable temperature. If it gets too cold, it goes dormant. Yeast that's too hot leads to heat prostration. Dough temperature will be dependent on your individual process. As a general guide, the ideal dough temperature for a refrigerated dough is about 78-82°F. The key is to determine your ideal dough temperature and maintain it. Be consistent.

Dough Temperature Control

Understanding the importance of dough temperature control is an important step toward product consistency for any pizza operator. The few dollars spent on a thermometer to track temperatures will go a long way for product quality.



There are four factors that affect dough temperature out of the mixer: shop, flour, bowl friction and water temperature. Of these four, water temperature is only the one that you can control. For the other three factors, it's important to know what they are and how they are measured.

Shop Temperature = ST Flour Temperature = FT Bowl Friction = BF

Assume that the ideal dough temperature is 80°F. Because there are three known factors (ST, FT, BF) multiply 80 x 3

80 x 3 = 240

Now subtract the sum of the three factors from 240 to get the desired water temperature to achieve an 80°F dough:

240 – (ST + FT + BF) = Water Temp

Here's an example with some real numbers. For bowl friction, use a value of 30. As the shop and flour warm up, the water temperature will go down and vice versa. Below is a quick guide to water temperature selection. The assumptions made for this chart include an ideal dough temperature of 80°F and a bowl friction of 30°F. Simply locate the shop temperature on the top row and flour temperature on the left column, follow until the row and column intersect and that value is the desired water temperature.

WATER TEMPERATURE CHART

FLOUR TEMPERATURE	ROOM TEMPERATURE															
	60	**62**	**64**	**66**	**68**	**70**	**72**	**74**	**76**	**78**	**80**	**82**	**84**	**86**	**88**	**90**
60	90	88	86	84	82	80	78	76	74	72	70	68	66	64	62	60
62	88	86	84	82	80	78	76	74	72	70	68	66	64	62	60	58
64	86	84	82	80	78	76	74	72	70	68	66	64	62	60	58	56
66	84	82	80	78	76	74	72	70	68	66	64	62	60	58	56	54
68	82	80	78	76	74	72	70	68	66	64	62	60	58	56	54	52
70	80	78	76	74	72	70	68	66	64	62	60	58	56	54	52	50
72	78	76	74	72	70	68	66	64	62	60	58	56	54	52	50	48
74	76	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46
76	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44
78	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42
80	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40
82	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38
84	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36
86	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34
88	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32
90	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30

Using the Water Temperature Chart*:
The intersection of the Room Temperature column with the Flour Temperature Row reveals the needed Water Temperature to achieve an 80°F ideal dough temperature.

Example Shown:
If room temperature is 72°F and flour temperature is 76°F, 62°F water is needed to achieve an 80°F dough.

*Chart based on targeting an 80°F ideal dough temperature with an estimated friction factor of 30°F

To learn more about General Mills Flour, talk with your sales rep or visit GeneralMillsCF.com.