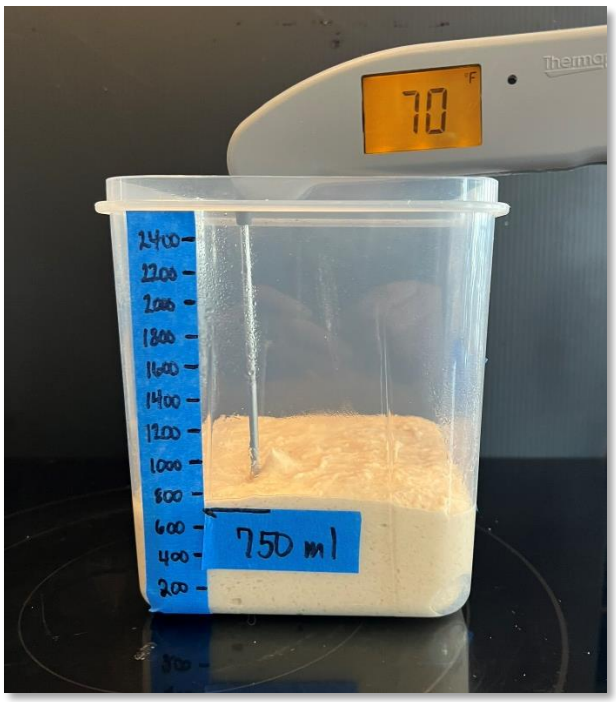
The SECRET of Bulk Fermentation

Measuring Dough Temperature and Percentage Rise

The Two-Factor Method



By Tom Cucuzza

The SECRET of Bulk Fermentation: Measuring Dough Temperature and Percentage Rise

By Tom Cucuzza, The Sourdough Journey © January 2024

Determining the cutoff point of bulk fermentation is one of the most difficult skills to develop as a sourdough baker. Experienced bakers claim that it takes hundreds (or more) bakes to develop the baker's intuition required to "read the dough."

For home bakers who bake weekly or less frequently, it is impractical to develop such skills through experience alone.

I have been working on this problem for years. After hundreds of experiments, I have developed a revolutionary method to help new sourdough bakers master bulk fermentation in a fraction of the time.

In sourdough baking, I hesitate to call anything "foolproof," but this method is as close as you can get. Bakers who have tested this method have called it "life changing."

The Mystery of Bulk Fermentation

If you survey the most popular sourdough recipes and methods, many provide inadequate guidance on how to determine the endpoint of bulk fermentation. Many recipes simply say, "let the dough rise at room temperature until it doubles." This guidance is generally useless. If your room temperature is 80F/27C, your dough will overproof. If your room temperature is 60F/16C, your dough will underproof. Some recipes attempt to provide more specifics, but the guidance is inconsistent with some recommending a 30% rise and some recommending a 100% rise in the dough.

Why do some recipes recommend a 30% rise and others a 100% rise? How is this possible?

The optimal percentage rise in bulk fermentation is related to the **dough temperature**. Warm-fermenting dough needs to be cut off earlier in bulk fermentation than cool-fermenting dough because **the dough keeps fermenting** in all of the downstream steps (shaping and final proof / cold retard). This fundamental relationship between dough temperature and the percentage rise is the basis of this new method.

Background

In 2021, I created two videos, and I ran many experiments looking into the relationship between dough temperature and percentage rise. In January 2023, I published the article, **The Mystery of Percentage Rise in Bulk Fermentation.** In that article I included this chart, summarizing my findings:

Bulk Fermentation Guidelines		
Dough Temperature	**Target Percentage Rise**	**Approximate Timing**
80F/27C	**30%**	**5.5 hours**
75F/24C	**50%**	**7 hours**
70F/21C	**75%**	**12 hours**
65F/18C	**100%**	**16 hours**
Note: Assumes a typical "Tartine" recipe and method. 90% Bread Flour, 10% Whole Wheat, 75% Water, 20% Starter, 2% Salt. Bulk fermentation begins when starter is added. Assumes a 12-16 hours cold retard at 37F/3C.		

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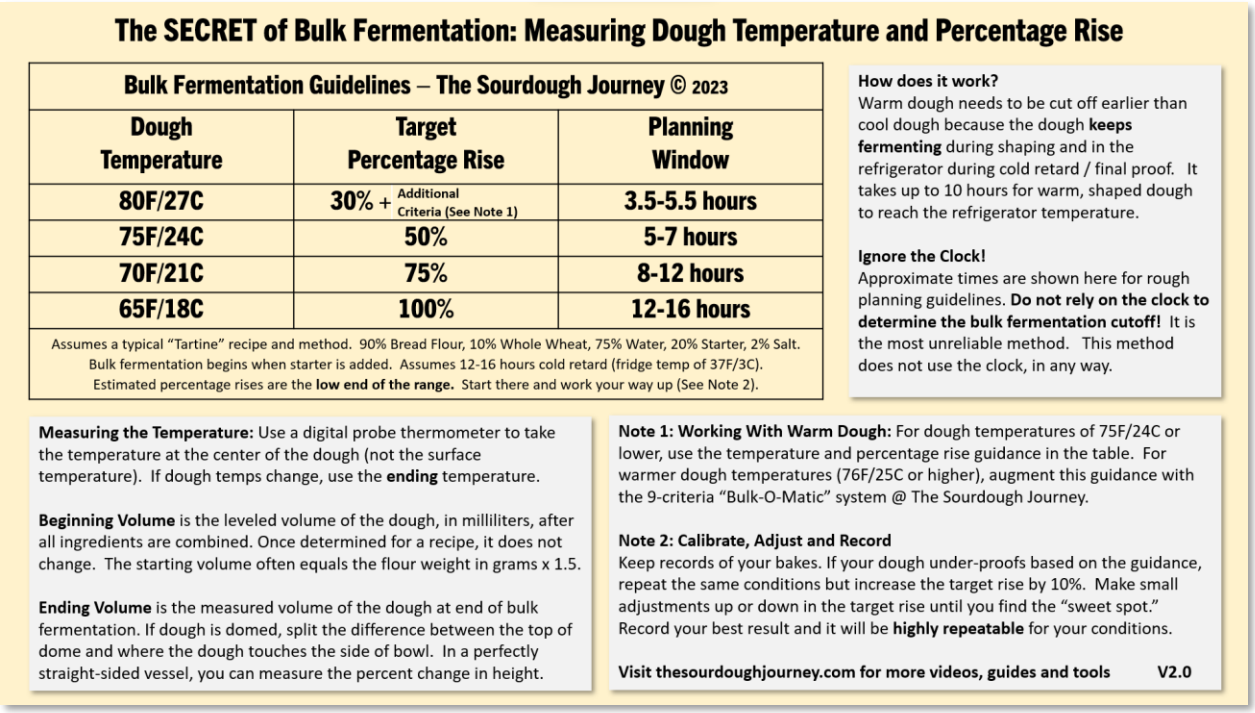
The article and the chart have become some of the most widely-referenced content in sourdough baking since its publication. I am continuously updating the document now. Please print the most updated version of the **Quick Guide here.**



The SECRET of Bulk Fermentation: Measuring Dough Temperature and Percentage Rise

Bulk Fermentation Guidelines – The Sourdough Journey © 2023

Dough Temperature	Target Percentage Rise	Planning Window
80F/27C	30% + Additional Criteria (See Note 1)	3.5-5.5 hours
75F/24C	50%	5-7 hours
70F/21C	75%	8-12 hours
65F/18C	100%	12-16 hours

Assumes a typical "Tartine" recipe and method. 90% Bread Flour, 10% Whole Wheat, 75% Water, 20% Starter, 2% Salt. Bulk fermentation begins when starter is added. Assumes 12-16 hours cold retard (fridge temp of 37F/3C). Estimated percentage rises are the **low end of the range.** Start there and work your way up (See Note 2).

How does it work?
Warm dough needs to be cut off earlier than cool dough because the dough **keeps fermenting** during shaping and in the refrigerator during cold retard / final proof. It takes up to 10 hours for warm, shaped dough to reach the refrigerator temperature.

Ignore the Clock!
Approximate times are shown here for rough planning guidelines. **Do not rely on the clock to determine the bulk fermentation cutoff!** It is the most unreliable method. This method does not use the clock, in any way.

Measuring the Temperature: Use a digital probe thermometer to take the temperature at the center of the dough (not the surface temperature). If dough temps change, use the **ending** temperature.

Beginning Volume is the leveled volume of the dough, in milliliters, after all ingredients are combined. Once determined for a recipe, it does not change. The starting volume often equals the flour weight in grams x 1.5.

Ending Volume is the measured volume of the dough at end of bulk fermentation. If dough is domed, split the difference between the top of dome and where the dough touches the side of bowl. In a perfectly straight-sided vessel, you can measure the percent change in height.

Note 1: Working With Warm Dough: For dough temperatures of 75F/24C or lower, use the temperature and percentage rise guidance in the table. For warmer dough temperatures (76F/25C or higher), augment this guidance with the 9-criteria "Bulk-O-Matic" system @ The Sourdough Journey.

Note 2: Calibrate, Adjust and Record
Keep records of your bakes. If your dough under-proofs based on the guidance, repeat the same conditions but increase the target rise by 10%. Make small adjustments up or down in the target rise until you find the "sweet spot." Record your best result and it will be **highly repeatable** for your conditions.

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By carefully measuring your dough temperature **and** the percentage rise in the dough, this simple method **massively** improves your likelihood of properly fermenting your dough, as compared to all other known methods.

For example, if you are bulk fermenting your dough at 80F/27C dough temperature, you would cut off bulk fermentation at a 30% rise. If you are bulk fermenting dough at 70F/21C, you would cut off bulk fermentation at a 75% rise. Note: This method assumes a cold retard / final proof in the refrigerator.

In both cases, you are achieving the same amount of **total fermentation** before the dough is baked, but the amount of fermentation that happens in bulk fermentation versus final proofing differs **based on the dough temperature.** Warm dough gets off to a fast start in bulk fermentation, but much of the fermentation continues in the refrigerator. With cool dough, most of the fermentation happens in bulk fermentation, and the refrigerator "finishes the job."

Consequently, warm dough needs to be cut off earlier (e.g., a 30% rise) because it continues rapidly fermenting during the shaping steps and in the refrigerator.

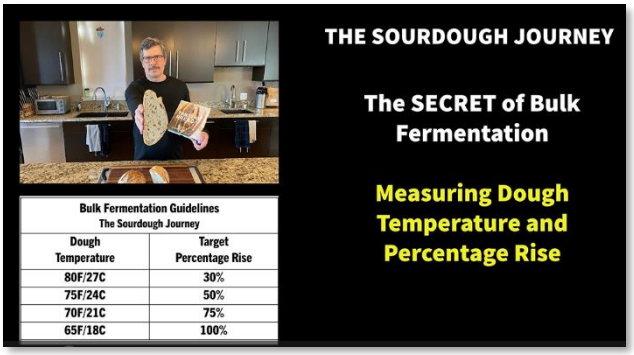
When bulk fermenting warm dough, you need to "hit the brakes" early on bulk fermentation because the dough keeps rapidly fermenting in all of the following steps.

A Note About Estimated Times

In this revolutionary method, you completely **ignore the clock.** I show the estimated bulk fermentation times in the chart simply to demonstrate the wide variations in times required to bulk ferment at different dough temperatures. However, measuring the bulk fermentation cutoff based on time is the **worst method** for determining when bulk fermentation is finished. It is an unreliable predictor because everyone's starter strength is different, and different types of flour ferment much more quickly or slowly than others. **The temperature and percentage rise do not lie!** Ignore the clock. Measure the temperature and the percentage rise in the dough, and this method is highly **reliable and repeatable.**

The Video

In January 2024, I launched the video, **"The SECRET of Bulk Fermentation: Measuring Dough Temperature and Percentage Rise – The Two-Factor Method"** In that video, I explain and demonstrate the science and practical steps of utilizing this method. This document is the companion to the video.



In this document, I summarize the key elements of the video, but I recommend watching the entire video, as it includes much more content, examples, and demonstrations.

Measuring Dough Temperature and Percentage Rise

PART 1: TOOLS

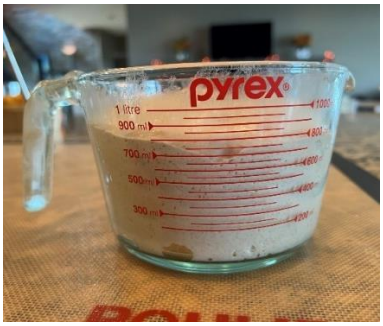
For this method, you will need a digital probe thermometer and a bulk fermentation measuring vessel.

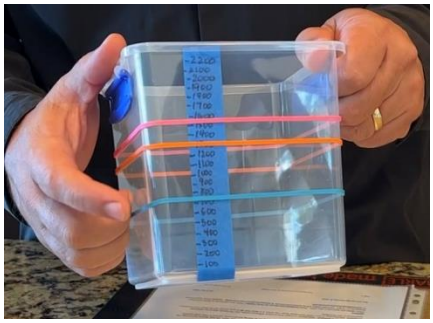
Thermometer

You will need a digital probe thermometer to use this method. Any digital kitchen probe thermometer (often called "digital meat thermometer or kitchen thermometer") will work. Use a digital thermometer, not an analog, dial-style "candy thermometer" – they are not accurate enough. Also, do not use an infrared thermometer. They only measure the surface temperature. You should measure the temperature at the center of your dough.

Bulk Fermentation Measuring Vessels

To use this method, you will need to accurately measure the percentage rise in your dough during bulk fermentation. This is usually done with a transparent vessel with milliliter markers on it. Some examples are shown here.





See **Appendix 1** for guidance on how to select the right fermentation vessel.

A Note on the "Standard Recipe"

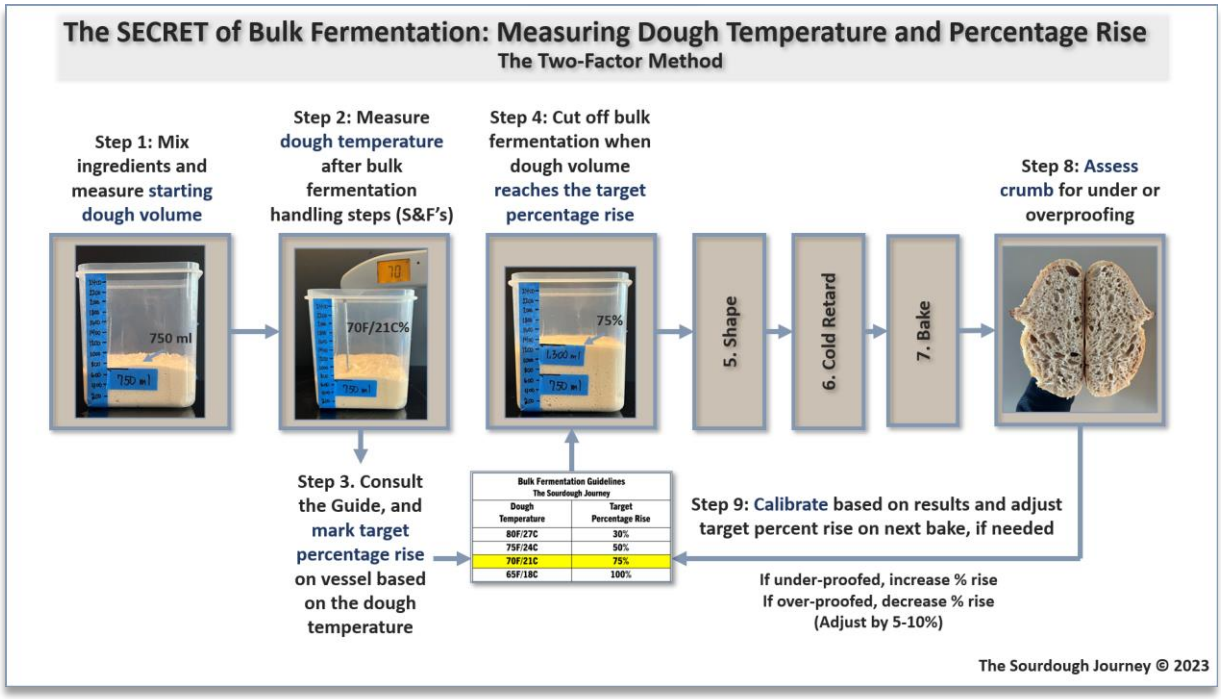
The baseline guidance is calibrated to Chad Roberton's popular Tartine Country Bread recipe which uses 90% bread flour, 10% whole wheat flour, 75% hydration, 20% starter and 2% salt. It employs a 30-minute bench rest between pre-shaping and final shaping, and a cold retard in the refrigerator (37-39F/4C) for 8-16 hours. Many sourdough recipes are based on Tartine, so this method will work with most popular sourdough recipes.

If your recipe varies widely from the standard (e.g., 100% whole wheat flour, very high hydration, low-protein flours, or inclusions) you may need to adjust the guidance, but the same principles apply to virtually **all** sourdough recipes. Later in this document we will discuss how to calibrate the guidance for your specifics.

Importantly, because this method does not rely on "time" as a criteria, all of the recipe variations that typically impact fermentation times (e.g., starter quantity, starter strength, when the starter is added) do not impact this method in any way.

Lastly, once you confirm the appropriate percentage rise for a recipe, at a given temperature, **it never changes.** Keep a baker's notebook, and in a short time you will master even your most complex recipes.

PART 2: THE TWO-FACTOR METHOD: DOUGH TEMPERATURE AND PERCENTAGE RISE



The basic steps of the method are:

1. Mix all of your ingredients and measure the **starting volume** of your mixed dough in a measuring vessel and mark the starting line (in milliliters).
2. After your last bulk fermentation handling step (S&F's), take your **dough temperature**.
3. Based on that temperature, look up the corresponding percentage rise for that temperature. Multiply your starting volume times 1 + the percentage rise, and **mark the target** on your vessel.
4. Wait and watch for your dough to reach the target percentage rise. Ignore the clock.
5. When your dough reaches the target rise, cut off bulk fermentation and shape the loaf.
6. Cold retard in the refrigerator for 8-16 hours.
7. Bake the loaf.
8. Cut the loaf and inspect the crumb. Assess if the loaf is underproofed or overproofed.
9. If necessary, calibrate your percentage rise up or down, and repeat the exact same process at the same temperature, but change only the percentage rise. If your crumb is underproofed, repeat the same steps, but add 10% to the target percentage rise. If your dough is overproofed, subtract 10% from the percentage rise. Continue making adjustments in 5-10% increments.

In a few bakes, you will dial in the perfect percentage rise for your recipe and environment. Once you determine the optimal percentage rise, **it never changes** for that recipe and dough temperature.

Working with Warm Dough (80F/27C)

Note: There is one exception when bulk fermenting at dough temperatures around 80F/27C. For warm dough, use the target percentage rise guidance in the table, but also augment your cutoff decision with the **Bulk-o-Matic** guide. That tool is a test of seven additional criteria to help dial in perfect fermentation with very warm dough. Warm dough often requires a more fine-tuned approach.

PART 3: THE DETAILS

STEP 1: MIX INGREDIENTS AND MEASURE THE STARTING VOLUME

Follow your normal recipe. After all the ingredients are mixed, move the dough to your measuring vessel. Do your best to level the dough in the vessel, and mark the starting line in milliliters.

The "Shorthand" Method – 1.5 times the weight of the dry flour in your recipe

If you are mixing a "standard" sourdough recipe using high-protein bread flour, 75% hydration, 20% starter and 2% salt, this mixture will typically mix up at 1.5x the flour weight of the recipe, in milliliters.

Weight of dry flour (in grams) x 1.5 = Mixed dough volume (in milliliters)

For example:

1) 400g flour-weight recipe will typically mix up to an initial volume of 600 ml, (400 x 1.5)
2) 500g flour-weight recipe will typically mix up to an initial volume of 750 ml, (500 x 1.5)
3) 1000g flour-weight recipe will typically mix up at an initial volume of 1,500 ml (1,000 x 1.5)

Note: Once you determine an accurate starting volume for a recipe, **it never changes.** Record the starting volume for each recipe in your baker's notebook, and you never need to measure the starting line again – it is always the same for that recipe.

FAQ: What about inclusions (e.g., olives, cheese, nuts, seeds)?

If you add inclusions early in the process (up to the second stretch-and-fold, for example), wait until all of the inclusions are added before marking your starting volume. The dough may begin slightly rising before the addition of the inclusions, but if you measure the starting volume consistently, for that recipe, it will produce consistent results. If you add your inclusions at pre-shaping, that has no impact on the starting or ending volume.

STEP 2: MEASURE THE DOUGH TEMPERATURE

After you finish your stretch-and-folds, take the temperature of your dough. Use a digital probe thermometer to test the temperature at the center of your dough. Do not test the surface temperature with an infrared thermometer. The surface temperature is not the best measurement to use.

FAQ: What is the "best" dough temperature for bulk fermentation?

There is no "best" temperature for bulk fermentation. You can bulk ferment beautiful dough at any temperature between 50F/10C to 90F/32C. If you synchronize the target percentage rise with the dough temperature, it will work. The "best" temperature is a dough temperature that you can maintain in your kitchen. If your kitchen is 72F/22C, that is the "best" dough temperature for bulk fermentation – for you.

You are not trying to "hit" a specific dough temperature by the end of bulk fermentation (this is not like cooking a steak!). For best results, you should maintain a consistent dough temperature throughout the process.

FAQ: What if my dough temperature changes during bulk fermentation?

You should monitor your dough temperature every 30-60 minutes throughout the process. Your dough temperature may change during bulk fermentation. If your temperature does change, you should adjust the target rise based on the **ending dough temperature.**

For example, some recipes call for mixing the dough with warm water. Assume you mix your dough, and its temperature is 80F/27C, but your kitchen temperature is 70F/21C. After your stretch-and-folds, your dough temperature may fall to 75F/24C. At that temperature you would target a 50% rise. However, as your dough continues fermenting, its temperature may continue dropping toward your kitchen temperature of 70F/21C. Continue to take temperature readings of your dough. If it looks like your **ending** dough temperature will be 70F/21C, you should **adjust your target rise** to a 75% rise, which is appropriate for 70F/21C. Dough temperatures change quite slowly.

This situation is relatively uncommon, but it can occur. Always be aware of your room temperature. Unless you are using a proofing chamber, your dough will always want to equalize to your room temperature.

STEP 3: DETERMINE THE TARGET PERCENTAGE RISE BASED ON THE DOUGH TEMPERATURE

Look up your dough temperature on the table and determine the target percentage rise in the dough.

For example:

If your dough temperature = 70F/21C, the target percentage rise should be 75% according to the table.

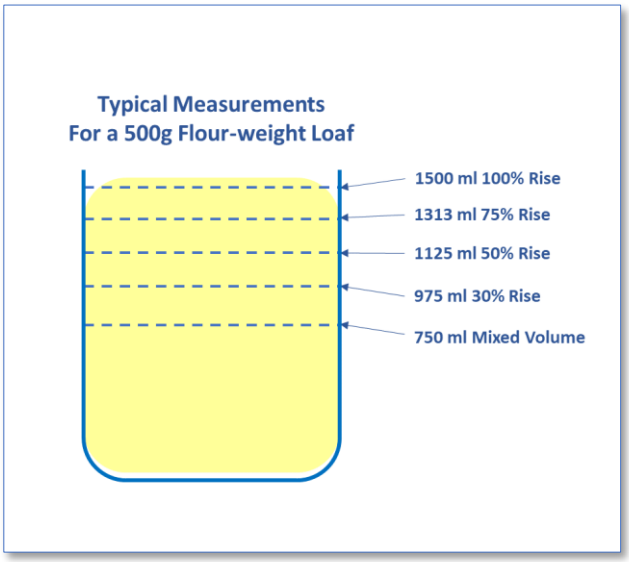
Multiply your starting volume, in milliliters by 1.75 to determine the ending volume in milliliters.

For example,

If your starting volume is 750 milliliters, 750 times 1.75 = 1,313 milliliters for a 75% rise.

Mark that number on your vessel. I usually round the calculations up or down to 50 ml increments. I would use 1,300 ml as my target 75% rise.

Here is an example of different target volumes for a 750 ml batch of dough.



STEP 4: MONITOR THE RISE AND DOUGH TEMPERATURE

Watch your dough and wait for it to reach the target percentage rise. **Ignore the clock and watch the dough!** When your dough reaches the target percentage rise, that is the end of bulk fermentation. (Reminder: if your dough temperature is 80F/27C, use the other 7 criteria in the **Bulk-o-Matic Guide**).

FAQ: What if my dough is domed on top? What is the ending volume in milliliters?

When your dough rises, it is very common for it to dome on top. This can make it challenging to determine the exact rise in milliliters. There is a simple solution.

1. Note the milliliter level where the dough is touching the side of the vessel. This is your "low point."
2. Look through the bowl at eye level and approximate the milliliter volume at the top of the dome. Image if you could lay a flat piece of cardboard across the top of the dome. This is your "high point."
3. Split the difference between the two numbers. For example, if the low point is 1,000 ml and the high point is 1,200 ml, your **ending volume** is 1,100 ml (the midpoint of the two numbers). This is a reasonable approximation that works very consistently.

STEP 5: CUT OFF BULK FERMENTATION AND SHAPE YOUR DOUGH

When your dough reaches the target rise, it is time to shape the dough.

I generally do a pre-shaping step, a 30-minute bench rest, then a final shaping step. You can follow whatever method your recipe recommends – just do it consistently.

After shaping your dough, put the dough in your shaping basket and move it to the refrigerator for the final proof / cold retard.

FAQ: My dough is sticking to the sides of my fermentation vessel.

When removing the risen dough from the measuring vessel, sometimes the dough will stick to the sides, especially if you are using a tall, narrow vessel. Before loading the dough into the measuring vessel (after the last handling step), spray the bottom and sidewalls of the measuring vessels with a non-stick cooking spray, or lightly coat it with oil. The dough will easily slide out of the vessel.

STEP 6: FINAL PROOF / COLD RETARD

Final proof your dough in the refrigerator for 8-16 hours. This method assumes your dough will reach a temperature of approximately 39F/4C.

FAQ: What is the optimal time for the cold retard? 8-16 hours is a large window.

In the video, I share a chart that shows it takes about 8-10 hours for your dough temperature to reach refrigerator temperature. Once it reaches your refrigerator temperature, the fermentation process dramatically slows down, so there is very little difference between 10 hours, 12 hours, 14 hours, or 16

hours. The **minimum** time in the refrigerator is 8 hours, and then dough ferments very slowly after about 8-10 hours in the refrigerator. Keep records of your cold retard times because they are an important part of the equation, but you have quite a bit of flexibility on when you remove your dough from the refrigerator – after 8-10 hours.

FAQ: What if I don't want to do a cold retard in the refrigerator. Can I do a countertop final proof?

This method is specifically calibrated for the cold retard method. The percentage rises in the table assume an 8 to 16-hour cold retard. If you do a countertop final proof, you will likely find that the bulk fermentation cutoff will be **too early,** and you will need to bulk ferment your dough to a higher rise.

Countertop final proofing is very difficult to predict by estimating the timing. For best results, you should always use the **"poke test"** to determine when the countertop final proof is ready for baking.

Experiment with slightly higher percentage rises than the guidance indicates, and if you keep good records, you can adjust the percentage rise for a countertop final proof in your environment after a few bakes. Again, once you dial it in, it will be **highly repeatable.**

STEP 7: SCORING AND BAKING

Remove your shaped dough from the refrigerator.

Important: Always take the temperature of your dough when it comes out of the refrigerator! The final dough temperature is an important data point. If your loaves are overproofing, they could overproof because your refrigerator is warmer than 39F/4C. The target rise guidance is based on the assumption that your dough temperature will reach 39F/4C or lower in the refrigerator after about 10 hours.

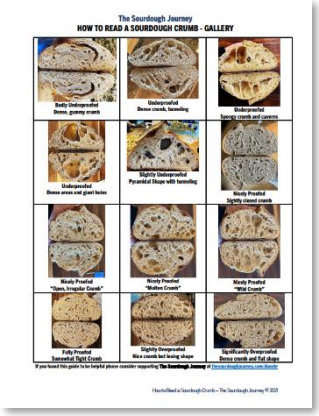
Score and bake your dough per your recipe.

You do not need to let your dough come up to room temperature before baking. I preheat my Dutch oven until the oven temperature reaches 500F/260C, then I load the dough, and bake at 450F/232C for 20 minutes with the lid on, and about 20 minutes with the lid off.

STEP 8: ASSESS YOUR CRUMB

Once your loaf has cooled (approximately 90 minutes), slice your loaf and compare the crumb to the chart **"How to Read a Sourdough Crumb,"** to determine if your loaf is underproofed, overproofed, or nicely proofed.

If your loaf is nicely proofed, congratulations! Celebrate your success and make a note of your successful bake in your baker's notebook. See **Appendix 2** for sample worksheet. **See Appendix 3** for printable worksheet.



STEP 9: CALIBRATION

If your loaf is underproofed or overproofed, it is easy to correct.

If your loaf is underproofed, repeat the same steps at the same dough temperature, but increase the target percentage rise by 10%.

If your loaf is overproofed, repeat the same steps at the same dough temperature, but decrease the target percentage rise by 10%.

For example, if your first loaf underproofed at 70F/21C and a 75% rise, then on your next bake, go for an 85% rise. Assess that crumb. If it is still underproofed, on the next bake, go for a 95% rise. If 95% then overproofs, then a 90% rise should be your perfect proofing level for that recipe and temperature.

Important Note: The target percentage rise guidance in the chart is set at the **low end of the range.** If your loaf is not perfectly proofed, it is much more likely that your loaf will be underproofed versus overproofed. The targets are intentionally set at the low end of the range so you can gradually work up, in small increments, to determine the perfect percentage rise for your situation. For many bakers, the standard guidance will work perfectly and will not need to be adjusted.

Once you determine your perfect proofing level for a given recipe, **it never changes** as long as you use the same type of flour and your dough temperature remains the same. This is the beauty of this method. It may take a few tries to dial it in, but once you figure it out it is **highly repeatable and nearly foolproof.**

Next Steps: The Role of Temperature and Time

As you develop your skills using this technique, you will find that you can manipulate your initial dough temperature by using warmer or cooler water, and you can control your dough temperature by using proofing boxes or other techniques.

By controlling your dough temperature, you will find that you can very accurately predict the **duration** of your bulk fermentation. We ignore timing to determine the bulk fermentation cutoff, but with experience, you will realize that with this method, the timing becomes **very predictable.**

With predictable fermentation times, you can fit more sourdough baking into a busy schedule. When you control temperature, you control time. And when you control time, you can make more sourdough.

Good luck! Consult my website at **thesourdoughjourney.com** for periodic updates to this document.

If you find this document helpful, please consider supporting The Sourdough Journey at **thesourdoughjourney.com/donate**

PART 4: TROUBLESHOOTING TIPS

FAQ: What is the impact of different types of flour?

Different types of flour can have significant impact on the percentage rise.

- The guidance is based on 12.5% protein bread flours such as King Arthur Bread Flour. Low-protein flours, such as all-purpose flours at 11.5% may not "show the rise" as much as higher protein flours, and the guidance should be adjusted down.

- High-protein flours "show the rise" more than low-protein flours. You should adjust your percentage rise upward from the standard with high-protein flours. For example, at 80F/27C, the guidance recommends a 30% rise, but I look for a 40% rise with certain high-protein flours.

- Low-gluten flours will not "show the rise" as readily. For example, einkorn, spelt, and other "ancient grains" tend to not rise as much as normal bread flours. Adjust your rise downward.

- Whole wheat flours can vary. Some brands show a tall rise, and some show a low rise. Dial in the best results for your specific brand of flour, and it will be repeatable.

- As noted before, if you keep records of each bake with each type of flour, it is **highly repeatable.**

FAQ: How should I choose my dough temperature?

Before mixing a batch of dough, it is always helpful to think, in advance, about your target bulk fermentation temperature. This decision sets up your entire process and schedule.

There are generally two options: 1) "room" temperature, or 2) using a proofing chamber.

- If you are planning to bulk ferment at room temperature, try to predict what your kitchen temperature will be for the duration of your bulk fermentation. For example, if I mix my dough in the evening in the winter, my initial kitchen temperature may be 72F/22C, but my overnight kitchen temperature will be closer to 66F/18C. So, I will calibrate my percentage rise target for 66F/18C dough temperature, which would give me a target percentage rise of 100%.

- If I'm planning for a fast, daytime bulk fermentation, I may use a warm proofer to bulk ferment my dough at 80F/27C. In this case, I would choose a target percentage rise of 30% based on the guidance. When bulk fermenting at warm dough temperatures, it is also critically important to initially mix your dough at the target temperature. It is very difficult to materially increase your dough temperature by using a proofing chamber. It can take hours to move the dough temperature a few degrees. Always try to hit your target temperature by using warmer water in your initial mixing. I typically use 90F/32C water for my initial mixing to hit a mixed dough temperature of 80F/27C.

FAQ: Should I use one bulk fermentation vessel or two?

Consult the **video** for my recommendations on how to use one or two bulk fermentation vessels.

Appendix 1: Selecting the Right Bulk Fermentation Vessel

When selecting your measuring vessel, consider the vessel size you will need based on your **typical batch size.** Here is table showing the recommended vessel sizes based on typical batch sizes from 1 to 4 loaves. The two rightmost columns show recommended sizes based on your typical fermentation temperature and likely percentage rises. If you do not know how you plan to ferment, choose the "Cool" fermentation column. Sizes are slightly rounded up to provide some headroom.

		Warm Fermentation	Cool Fermentation
Number of Loaves @ 500g	**Starting Mixed Volume 1.5 x flour weight (approx.)**	**BF Vessel Size @ 50% Rise Rounded up 75-80F/24-27C**	**BF Vessel Size @ 100% Rise Rounded up Under 75F/24C**
1 loaf = 500g flour	**750 ml**	**1.2 - 2 L/Qt**	**2 – 3 L/Qt**
2 loaves = 1000g flour	**1500 ml**	**2.25 – 3 L/Qt**	**3 – 4 L/Qt**
3 loaves = 1500g flour	**2250 ml**	**3.38 – 4 L/Qt**	**4.5 – 5 L/Qt**
4 loaves = 2000g flour	**3000 ml**	**4.5 – 5 L/Qt**	**6 – 7 L/Qt**

Before purchasing a vessel, you may also want to consider how you plan to do your bulk fermentation dough handling (e.g., stretch-and-folds).

I suggest watching the **video** to see the method I use for marking my vessel and how I move the dough into the vessel in bulk fermentation. With this method, you have two options:

1) Stretch-and-fold in the measuring vessel – in this case, you want a large enough vessel that you can get your hands into it to perform the stretch-and-folds. Rectangular Cambro storage containers are a popular choice. You are using the same vessel for folds and for measurement.
2) Stretch-and-fold in a bowl – In this case, you perform your stretch-and-folds in a bowl, then move your dough to your measuring vessel after the last stretch-and-fold.

Also, if you use a warm or cold proofer, you should choose a vessel that will fit in your proofer.

You can find recommended fermentation vessels at **thesourdoughjourney.com/products/**

FAQ: Do I need to buy a fermentation vessel?

No. You can make your own measuring vessel. Check out the **video** for instructions on how to do this.

To make your own measuring vessel (of any shape or size):

- Place your vessel on a scale
- Put a piece of tape vertically from the top to bottom of the vessel, on the outside
- Add 100g of water to the vessel and mark that level on the tape
- Continue until the vessel is full
- Dump out the water and write your measurements on the tape (100, 200, 300, 400, etc.)

Note: 100g water = 100ml. Water is the only liquid where the weight in grams and the volume in milliliters are exactly the same.

Appendix 2: Baking Worksheet – Sample

The Sourdough Journey - The Two-Factor Method: Temperature and Percetage Rise ©

Date:	

Ingredients	Qty (g)	%	NOTES
Flour 1:	450	90%	*Bob's Red Mill Artisan Bread Flour*
Flour 2:	50	10%	*Central Milling Whole Wheat Flour*
Flour 3:		0%	
Total Flour	500	100%	
Starter/Leaven	100	20%	*Overnight leaven build 1:10:10, passed float test*
Water	375	75%	*70F water temp*
Salt	10	2%	*Himilayan Pink Salt*
Total Ingredient Weight	985	77%	**Total Hydration % Including Starter**

Bulk Fermentation Guidelines The Sourdough Journey © 2023		
Dough Temp	Target % Rise	Planning Window
80F/27C	30%	3-5.5 hrs
75F/24C	50%	5-7 hrs
70F/21C	75%	8-12 hrs
65F/18C	100%	12-18 hrs

Note: "Temp" is Dough Temp

Mix Ingredients	Time	Starting Volume in Milliliters	Temp	Mixing Time
	8:00 a.m.	*750 ml*	*72F/21C*	*60 min*

Bulk Fermentation Handling	Time		Temp	BF Handling Time
Round 1	*9:00*	*Stretch and Fold*	*72F/22C*	
Round 2	*9:30*	*Stretch and Fold*	*71F/21C*	
Round 3	*10:00*	*Coil Fold*	*71F/21C*	*1.5 hours*
Round 4	*10:30*	*Coil Fold*	*70F/21C*	
Round 5				

Set Target % Rise	Starting Volume (ml)	Target % Rise from Table	Target Volume (ml)	Temp
	750 ml	*75%*	*1,313 ml*	*70F/21C*

Bulk Fermentation End When Dough Volume Equals Target	Time		End Temp	Total Ferment Time
	5:00 p.m.	*Dough was slightly domed on top. Dough was touching edge of vessel at 1,300 ml*	*70F/21C*	*9 hours*

5. Divide and Preshape	Time		Temp	Bench Rest Time
	5:00 p.m.	*Tartine preshape method. Dough was somewhat stiff.*	*71F/21C*	*25 min*

6. Final Shaping	Time		Temp	Shaped Rest Time
	5:25 p.m.	*Tartine batard and boule methods. Dough was supple and nicely proofed. Moved to bannetons and directly to fridge*	*70F/21C*	*None*

7. Final Proof/Cold Retard	Time		Temp	Final Proof Time
	5:30 p.m.	*14.5 hours in fridge, top shelf, right, back*	*39F/4C*	*14.5 hours*

8. Scoring and Baking	Time		Temp	Baking Time
	8:00 a.m.	*Preheated oven to 500F for 25 minutes*	*PH 500 450F*	*20 min lid on 20 min lid off*

Crumb Assessment and Calibration Notes

Loaf was slightly underproofed. Will try same temperature and 85% rise on next bake.

Appendix 3: Baking Worksheet – Blank

The Sourdough Journey - The Two-Factor Method: Temperature and Percetage Rise ©

Date:	

---------- NOTES ----------

Ingredients	Qty (g)	%	
Flour 1:			
Flour 2:			
Flour 3:			
Total Flour			
Starter/Leaven			
Water			
Salt			
Total Ingredient Weight			Total Hydration % Including Starter

Bulk Fermentation Guidelines The Sourdough Journey © 2023		
Dough Temp	Target % Rise	Planning Window
80F/27C	30%	3-5.5 hrs
75F/24C	50%	5-7 hrs
70F/21C	75%	8-12 hrs
65F/18C	100%	12-18 hrs

Note: "Temp" is Dough Temp

Mix Ingredients	Time	Starting Volume in Milliliters	Temp	Mixing Time

Bulk Fermentation Handling	Time		Temp	BF Handling Time
Round 1				
Round 2				
Round 3				
Round 4				
Round 5				

Set Target % Rise	Starting Volume (ml)	Target % Rise from Table	Target Volume (ml)	Temp

Bulk Fermentation End When Dough Volume Equals Target	Time		End Temp	Total Ferment Time

5. Divide and Preshape	Time		Temp	Bench Rest Time

6. Final Shaping	Time		Temp	Shaped Rest Time

7. Final Proof/Cold Retard	Time		Temp	Final Proof Time

8. Scoring and Baking	Time		Temp	Baking Time

Crumb Assessment and Calibration Notes