# A Guide to Sourdough Bulk Fermentation

# using

# The Bulk-O-Matic System


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# The Bulk-O-Matic System

The Bulk-O-Matic System is a nine-factor tool used to help beginning sourdough bakers determine the optimal end point of Bulk Fermentation in sourdough bread baking. This tool was introduced in the video "When is Bulk Fermentation Done: Episode 3 – The Bulk-O-Matic System" on The Sourdough Journey channel on YouTube in December 2020. For a link to the video, click **here.**

For more detailed instructions and a demonstration of each test, please watch that video. The other videos in the "When is Bulk Fermentation Done?" series also use the tool and focus on different variables (e.g., time, temperature, percent rise, starter strength).

A printable blank version of the tool, in black and white, is included on the last page of this document.

**Important:** The tool is specifically calibrated based on the **Tartine Basic Country Bread** recipe from Chad Robertson's book "Tartine Bread." The book is highly recommended. The recipe is also available for download on the Tartine Bakery website. For a link to the recipe, click **here**.

When closely following the recipe and process, the tool has proven to be very reliable. Deviations from the standard recipe may cause the tool to be less reliable. Additional calibration and recipe adjustments are included at the end of the document.

**Version 2.0 and 3.0 Revisions**

1) Percentage Rise – According to the Tartine method, the target percentage rise is indicated as 20-30%. Based on all of my experience and input from others, I am **adjusting the range to 25-35%.** Unless you have a super-strong starter it is uncommon for a 20% rise to be sufficient, and bakers tend to underproof this recipe based on this guidance.
2) Additional Temperature Options – I have added a section at the end of this document describing additional techniques and tools for bulk fermenting at lower temperatures (66-74F / 19-23C).
3) Other minor modifications and clarifications.

## The Nine Criteria in the Bulk-O-Matic System

1. **Temperature**
2. **Time**
3. **Percent Rise**
4. **Domed on Top**
5. **Bubbles on Top**
6. **Bubbles on Sides**
7. **Wobble Test**
8. **Windowpane Test**
9. **Smell Test**

# The Nine Tests for Determining Completion of Bulk Fermentation

### TEST #1 - TEMPERATURE

1. **Temperature** – Dough temperature is the most important variable in managing bulk fermentation. The target bulk fermentation temperature range is 78-82F / 25.5-28C. Use a probe thermometer to test the internal temperature in the center of your dough throughout bulk fermentation (e.g., every 30 minutes).

   Use a proofing chamber, if necessary, to keep a consistent dough temperature throughout bulk fermentation. Managing and measuring dough temperature during bulk fermentation is the most important skill for beginners to develop.

   Your temperature reading in the tool should be the **average** temperature throughout bulk fermentation, not the ending temperature. For example, if you recorded the following hourly temperature readings of 79F, 80F, 81F, 82F and 83F over 5 hours, the average bulk fermentation temperature would be 81F. The target temperatures are also inextricably linked to the estimated time, so always consider temperature and time together. Best results are achieved with consistent temperatures throughout bulk fermentation.

   **Underproofing –** It would be **very uncommon** for the dough to bulk ferment in the recommended timeframe (3.5 to 4.5 hours) at temperatures below 78F / 25.5C. It is possible o bulk ferment at lower temperatures (not recommended below 70F/21C) but this will lengthen the fermentation time considerably.

   **Desired Range –** The Tartine recipe tends to bulk ferment nicely between 78-82F / 25.5-28C. That temperature range is **typically required** to finish bulk fermentation within the recommended timeframe of 3.5-4.5 hours.

   **Overproofing –** As your dough temperature begins to exceed 82F/28C you are at risk of overproofing within the recommended timeframe. It is possible to bulk ferment at slightly higher dough temperatures, however temperatures above 90F/32C are not recommended. As the dough temperature approaches this high temperature, the risk of overproofing and gluten deterioration increases dramatically. Bulk fermenting at warmer temperatures is much risker than at cooler temperatures. Warmer temperatures break down gluten, cooler temperatures just add more time to the process.

### TEST #2 – TIME

2. **Time** – Bulk fermentation time, or duration, is inextricably linked to bulk fermentation temperature. And time is the **last** indicator that should be used to determine if bulk fermentation is done. Watch the dough, not the clock. Use the other variables in the tool first, then use time as your final confirmation.

Bulk fermentation time is measured from the point of adding the starter/leaven to the water and flour. The recommended fermentation time is 3.5-4.5 hours from the time the leaven is added to the dough (at the target temperature).

Note: This is a 30-minute deviation from the Tartine vernacular which describes bulk fermentation as beginning after the fermentolyse step (when salt is added). The recommended times in this tool are adjusted accordingly (they are 30 minutes longer than in the book, but the total times are the same, to account for the fermentolyse step, which includes the starter/leaven). This adjustment allows the tool to be used consistently with other recipes.

Note: Bulk fermentation time, or duration, is highly influenced by your **starter strength**. Bulk fermenting with a weak starter can take almost twice as long as when using a strong starter! Because starter strength is not directly measurable it can result in seemingly unexplainable variations in bulk fermentation times from one bake to the next. Work on establishing a routine of consistently preparing your starter for baking to reduce variability.

**Underproofing** - It is **very uncommon** for the dough to complete bulk fermentation in less than 3.5 hours at the recommended temperature range of 78-82F / 25.5-28C. Completing bulk fermentation in less than 3.5 hours at the target temperature range would require an uncommonly strong starter and/or a highly active flour blend (e.g., fresh milled flour will ferment faster).

**Desired Range** – The recommended bulk fermentation time, per the recipe, is 3.5 to 4.5 hours. It is difficult to achieve the 3.5 hour target without a very strong starter. Many home bakers tend to underproof this recipe when strictly following the recommended bulk fermentation times. It is not uncommon for bulk fermentation time to take 5 or 5.5 hours at the recommended temperature for many home bakers. Do not be afraid to push the timing longer, if the other variables indicate bulk fermentation is not done within the recommended timeframe.

**Overproofing** – Overproofing can begin at 4.5 hours but is more typical after 5.5 or longer. Other indicators in this tool should show signs of overproofing before you should make a decision based on time. The time estimate is the least reliable of the indicators and other factors should be weighted more heavily.

**TEST #3 – PERCENT RISE**

3. **Percent Rise** – The percent rise should be measured as the percent change in milliliter volume after all of the ingredients are mixed into the dough (i.e., after adding the salt in this recipe). Use a straight-walled, transparent vessel with milliliter volume measurements to measure the percent rise. The recommended percentage rise in the Tartine recipe is 20-30%. It is uncommon for the dough to be fully fermented at a 20% rise, so I've recently adjusted the guidance here to 25-35%, which is more consistent with my and others' experience.

After mixing all of the ingredients, mark the starting volume on your vessel. Try to level the dough in the container to mark an accurate starting point. Also note that the percent rise is the change in volume, not height. Height and volume are only equal if you are using a perfectly straight-walled vessel. With the Tartine recipe, a rule of thumb is that your starting volume in milliliters will typically be 1.5x the starting flour weight in grams. For example, a 1,000 gram flour-weight recipe will typically have a starting volume, after all ingredients are combined, of 1,500 milliliters.

It can be difficult to measure the percent rise while performing stretch and folds, per the recipe, but there is typically little measurable rise in the dough during the first few hours of bulk fermentation. After the last stretch and fold, the dough will typically settle in the vessel and it will be easier to measure the percent rise at that time. Do not try to "level" the dough after the stretch and folds or you may de-gas it by pressing down on it.

Most of the rise in the dough happens in the last 15-20% of the bulk fermentation duration. For example, in a 4.5 hour total duration, most of the rise will occur in the last 40-55 minutes. It is normal for the dough to rise very slowly at first. Watch the dough closely as you begin to see it rising near the end of bulk fermentation. Big changes can occur quickly at the end.

Sometimes the dough will be domed in the center and difficult to measure. If the dough is domed in the center, approximate the "average" rise. For example, if the sides of the dough are at 20% and the center is at 30%, the average rise would be 25% (or possibly higher depending on the shape of the dome). Try to approximate the height of the overall mass of dough, not necessarily the highest point. Imagine if the dough liquified and leveled itself at that moment to predict where the "top" of the dough would evenly settle in the vessel.

**Underproofing** – It is **extremely uncommon** for the dough to properly bulk ferment without seeing at least a 25% rise. The percent rise is a very reliable indicator of bulk fermentation. Occasionally you may have a very slow-moving batch of dough. Check your dough temperature and give it more time.

**Desired Range** – The target percent rise is 25-35% increase in volume. The percent rise, when accurately measured, is a **very reliable** indicator of bulk fermentation completion for this recipe. While the published range is 25-35%, most home bakers typically shoot for 30% or in some cases higher (e.g., 40%) depending on how the other variables look. This recipe tends to underproof for many home bakers, so a 35-40% rise is a common target used by many bakers of this recipe. Push the percent rise to the high end of the range (or higher) each time to bake to find your optimal cutoff point. There is much more risk of underproofing at 25% than overproofing at 40%. In other words, there is more risk on the downside than the upside of the range.

**Overproofing** – There is a fairly wide margin of error before badly overproofing based on the percent rise. A 50% rise can still produce a well-proofed loaf (depending on other variables). With this recipe, at the target temperatures, serious overproofing typically occurs above 60%

rise. Overproofing is certainly a risk at a 100% increase, or doubling in volume, which is recommended in some other recipes but generally does not work in this recipe due to the high bulk fermentation temperature.

Also note, with an immature starter or very weak starter, it is possible to overproof the dough without seeing a 35% rise in the dough. If the yeast is weak, the gluten integrity will start to break down and the rise will "stall" somewhere before reaching 35% rise. In these cases, consider the other variables to determine if the dough is overproofing. When you see the dough reach a "stall point" the percent rise will stop before reaching the target, and all of the other variables will keep moving toward the overproofing range. This is usually a sign of a weak or very acidic starter/leaven.

**TEST #4 – DOMED ON TOP**

4. **Domed on Top** – The dough should be noticeably domed on top. Look for a "shoulder" around the edges of the dough where it touches the bowl.

   **Underproofed** – Underproofed dough will be fairly flat on top. However, in some cases, the dough may show a "false dome" because it is still simply rounded on top from the last stretch and fold, but will otherwise the dough will be very stiff. Over time you will begin to see the difference between "stiff, rounded" dough from the last stretch and fold, versus true aerated doming on top.

   **Desired Range** – The dough should be domed on top as a result of carbon dioxide building up in the gluten matrix and pushing up the center of the dough. Doming is an early indication of the beginning of the measured percent rise and later in the process it is an indication that the yeast is still vigorously producing carbon dioxide. You should see a "shoulder" around the edge of the dough in the bowl.

   **Overproofed** – Overproofed dough typically will achieve a dome earlier in the process and then will begin to flatten out and lose its dome and "shoulder" around the edges of the bowl. If the dome has fallen and is flattening out after a prior dome, it is a sign of overproofing.

**TEST #5 – BUBBLES ON TOP**

5. **Bubbles on Top** – Large bubbles on the top surface of the dough are a good indication of vigorous fermentation.

   **Underproofing** – If there are no bubbles on top, your dough may not be ready, but this is not a foolproof indicator. You should see some bubbles on the top of your dough when bulk fermentation is complete, but this is not a required criteria, and some fully fermented dough will not show bubbles on top.

**Desired Range** – You will typically see bubbles emerging on the top of your dough as it approaches the end of bulk fermentation. 4-8 large bubbles would be a common but develop your own experience as a guide.

**Overproofing** – If bubbles appeared on the top of the dough during bulk fermentation and then deflate, that is an indication the dough is overproofing. You may also see thinning of the bubble membrane as it approaches overproofing.

**TEST #6 – BUBBLES ON SIDES**

6. **Bubbles on Sides** – Bubbles in the dough are an early preview of the crumb of the loaf. Vigorous bubbling indicates active fermentation inside the dough.

   **Underproofing** – If there are minimal or no bubbles visible in the dough through the side of the vessel, this is an indication of low fermentation activity and the dough is typically not ready.

   **Desired Range** – Look at your dough through the sides of your transparent vessel. You should see a large number of bubbles in the dough. The bubbles will typically be smaller in size than what you would see in the crumb and may be clustered in certain areas of the bowl. But the clusters should have a high density of bubbles and you should see some large, medium and small bubbles in the dough.

   **Overproofing** – If the bubbles begin to shrink in size or number, the dough may be beginning to overproof.

**TEST #7 – WOBBLE TEST**

7. **Wobble Test** – The Wobble Test is done by shaking the bowl and observing the movement of the top surface of the dough in the bowl. A well-fermented dough should look loose and aerated. The Wobble Test is a more subjective test that one needs to develop a feel for. Look for movement of the dough around the edges of the bowl, or the "splashing" of the dough. The movement is very subtle and is not as pronounced as if it were liquid splashing, but over time, you will develop a feel for how much it should move.

   **Underproofing** – Underproofed dough is very stiff when you shake it in the bowl and you will see very little movement in the top of the dough.

   **Desired Range** – When the dough is sufficiently fermented, you should see movement in the top layer of the dough and a subtle "splashing" of the dough against the sides of the bowl. This takes some experience to develop an eye for this but is a **very reliable** indicator once you develop a feel for it.

**Overproofing** – When the dough starts to liquify in the bowl this is an indication of overproofing. The top of overproofed dough will also often be shiny, with visible gluten strands emerging.

**TEST #8 – WINDOWPANE TEST**

8. **Windowpane Test –** the windowpane test should be done periodically during bulk fermentation. You should be able to pull a strong, translucent membrane of dough to determine when you have sufficient gluten development. However, it is also helpful to continue to test the windowpane later in bulk fermentation to get a feel for when the dough starts to tear and break down. This is an indication the dough is heading towards overproofing.
9. **Underproofing** – Underproofed dough (and/or with underdeveloped gluten) will be very stiff, thick and cannot be stretched into a thin, strong, translucent windowpane. Very under-developed dough will also tear easily.

   **Desired Range** – When fully developed and fermented, the dough can be stretched into a strong, thin, translucent windowpane. Some tearing around the edges is expected with recipe, such as Tartine, which contain whole grains. Whole grain flours include bran which cuts the gluten strands and causes some tearing of even the strongest windowpane.

   **Overproofing** – As dough begins to overproof, the windowpane will become very thin, tear easily and will lose its strength. With the most extreme overproofing, the dough will fall apart in your hands. A deteriorating windowpane is one of the **best, early indicators** of overproofing.

**TEST #9 – SMELL TEST**

10. **Smell Test –** The baker should continually smell the bulk fermenting dough throughout bulk fermentation. The smell of the dough is a reliable indicator of bulk fermentation progress.

    **Underproofing** – Underproofed dough will smell like flour. The smell of the flour and water mixture that occurs when initially mixing the dough will continue through the early stages of bulk fermentation while the dough is still insufficiently fermented.

    **Desired Range** – Early in the desired range the dough will take on a "ripe" smell. This is the subtle smell of a ripening or fermenting fruit. Later in the desired range, the dough will take on a very sweet, fragrant smell. And late in the desired range you may start to smell some acidity. The smell test is subject to individual interpretation, but when you find your own "sweet spot" this test is repeatable and **very reliable.**

    **Overproofing** – As the dough begins to overproof, it will start to smell more acidic. It may still smell sweet but the acidic tones will begin to emerge and overpower the sweet smell. When completely overproofed, your dough would smell like your starter.

**Assessing the Nine Variables**

The 9 variables are not all equally weighted. You should view all of the variables as a "constellation" of data points which must be assessed collectively. The Bulk-O-Matic system cannot be reduced to a mathematical formula. It is a tool to help beginning bakers develop fact-based intuition which is more powerful than any mathematical equation.

Some considerations:

**Time and Temperature:** Time and Temperature must always be looked at together. They cannot be separated. The combination of time and temperature can be highly influenced by the strength of your starter/leaven.

**Underproofing:** The most reliable indicator of underproofing is the percent rise. The rise does not lie. Learn to measure it accurately because your eyes can play tricks on you without accurate measurements.

**Overproofing** – The earliest indication of overproofing is the windowpane test. When the windowpane starts to weaken and deteriorate in your hands it is a sign of gluten deterioration and overproofing.

**Additional Considerations and Calibrations**

1. **Temperature**- Temperature has the most significant impact on bulk fermentation of any of the variables. If your bulk fermentation time is outside of the recommended range it will most certainly impact the bulk fermentation time. In addition, high temperature bulk fermentation (e.g., 90F / 32C) also impacts the chemistry of the dough and can lead to rapid overproofing. See **"When is Bulk Fermentation Done? : Episode 7 – "Some Like it Hot – Impact of Temperature"** for additional insight and guidance on this topic. Different bulk fermentation temperatures can also impact the feel and behavior of the dough. For example, when bulk fermenting at lower temperatures, the dough can typically tolerate a higher percent rise before overproofing. Conversely, bulk fermenting at higher temperatures typically require a lower percent rise.

2. **Temperature and Percentage Rise –** The target percentage rise in the dough must be synchronized with the dough temperature. For example, when bulk fermenting dough at 80F/27C, the target rise is 25-35%. However, when bulk fermenting at 70F/21C, the target rise is 75-100%. The reason is because at warm dough temperatures, the dough keeps rapidly fermenting in all of the downstream steps, so you need to "hit the brakes" earlier. Check out this paper, **"The Mystery of Percentage Rise in Bulk Fermentation,"** for more details on this important topic.

3. **Tools for Lower Temperature Bulk Fermentation –** When bulk fermenting at lower temperatures, all of the same variables can still be applied, but the **percentage rise** is, by far, the most important indicator of bulk fermentation completion when bulk fermenting at 66-74F / 19-23C. I have created new **Bulk Fermentation Timetables** for planning your bulk fermentation in this temperature range. Please consult the video**, "Post Pandemic Sourdough for Busy People**

– The Low and Slow Method," for details on how to use these tables and how to calibrate your results against the tables.

4. **Hydration Levels** – The standard recipe is based on 75% water (and 77.45% hydration including the stater hydration). Higher or lower hydration levels can significantly impact the bulk fermentation times, the windowpane, the wobble test, etc. Future versions of this tool will be developed for different hydration levels.

5. **Different Flours** – The Bulk-O-Matic System is calibrated based on the Tartine Country Bread Recipe which uses 90% bread flour and 10% whole wheat flours. Changing the mix or type of flours will have a **dramatic** impact on many of the bulk fermentation variables and the system may be unreliable with deviations from the standard flour mix. For example, whole grain flours tend to ferment faster, will produce a weak windowpane and may or may not show the same type of percent rise as the bread flour. Future versions of this tool will be developed for different flour formulations.

6. **Leaven Percentages** – The standard recipe calls for 20% leaven. Increasing that percentage will generally speed up bulk fermentation and reducing that percentage will slow down bulk fermentation. This topic is explored in Episodes 5 and 6 of "When is Bulk Fermentation Done?"

7. **Salt Percentages** – The standard recipe is based on 2% salt. Lower salt percentages speed up fermentation process and slow down gluten development.

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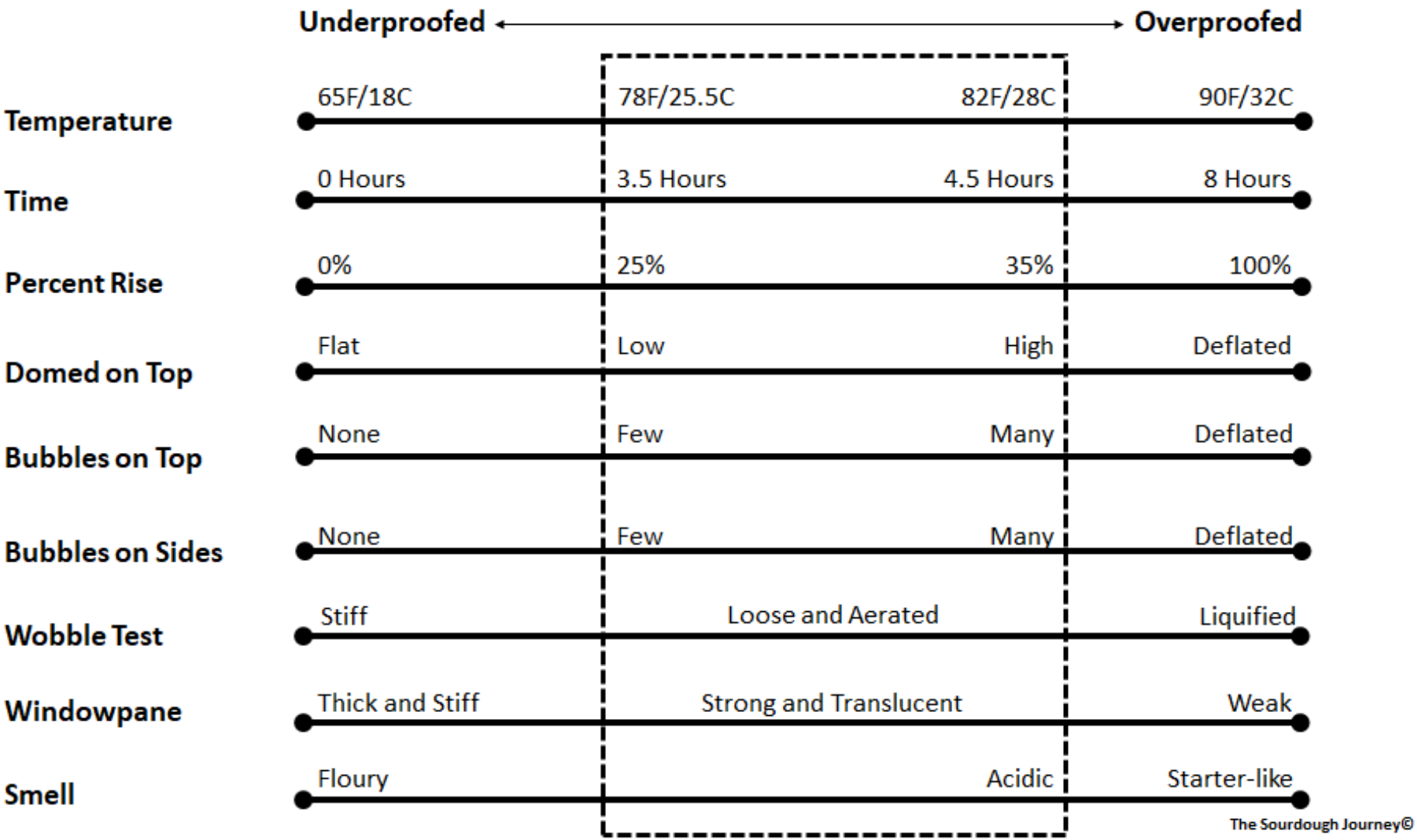
Underproofed
Overproofed
Temperature
65F/18C
78F/25.5C
82F/28C
90F/32C
Time
0 Hours
3.5 Hours
4.5 Hours
8 Hours
Percent Rise
0%
25%
35%
100%
Domed on Top
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None
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Many
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Loose and Aerated
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Thick and Stiff
Strong and Translucent
Weak
Smell
Floury
Acidic
Starter-like
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