

# Best Mixing Practices For Superior Refractory Performance



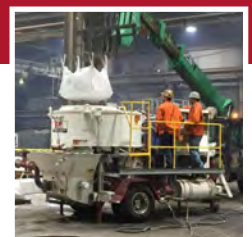
## The Secret to Better Refractory Durability and Efficiency - Mixing for Success

Unlocking the secret to better refractory durability and efficiency starts with mastering proper mixing techniques. In industries like steel, aluminum, and power generation, correct mixing is crucial for achieving peak material performance. Proper mixing not only boosts durability but also significantly enhances thermal efficiency and mechanical strength. By following best practices, material performance can improve by up to 25%, highlighting the profound impact of correct mixing on refractory installation, repair, and management. Mixing for success is the key to unlocking the full potential of refractory materials, driving efficiency, and ensuring long-lasting durability.

### Top Tips for Ideal Refractory Mixing

To ensure proper mixing and achieve the associated benefits, the following best practices should be adhered to:

- **Follow Manufacturer Guidelines:** Always adhere to the manufacturer's instructions regarding the proportions of water and dry mix, mixing times, and methods. Generally, the ideal mixing and placement temperature for refractories, water, and ambient conditions is between 60°F (16°C) and 90°F (32°C). If ambient conditions drop below 45°F (7°C) after placement, setting may be delayed. Conversely, high ambient and material temperatures above 90°F (32°C) can lead to reduced working/setting times or flash setting.
- **Use Proper Equipment and Water:** Utilize appropriate mixing equipment, such as paddle mixers or high-shear mixers, to achieve a thorough blend. Confirm the mixing water is clean and potable (i.e., drinking quality). Start the mixer and fully empty the contents of one or more packages (bags or super sacks). Initially, add 90% of the specified mixing water indicated on the package or data sheet for the first batch. Allow the mixture to "wet down" before adding more water to achieve the desired consistency. A wetter mix may handle more easily, but it robs the refractory material of its needed strength. Conversely, a mix that is too dry is difficult to place and may set to a weak, porous, and "popcorn" like structure.



- **Monitor Consistency:** Regularly assess the mix's uniformity to ensure consistency. Mixing times will vary based on the mixer type and action needed to dissolve, disperse, and achieve proper "wet down". Adjust mixing parameters as needed to maintain consistency. After the initial batch, use the final water amount as a starting point for subsequent batches for consistency. Occasional water adjustments may be necessary during installation or repairs to uphold desired consistency. Use a device like a watch or the timer/stopwatch on your mobile phone to accurately record the length of time the refractory is mixed. Ensure that personnel involved in the mixing process are well-trained and supervised to follow best practices and manufacturer guidelines. Implement rigorous quality control measures to monitor and verify mixed refractory consistency and quality.

### **The Costly Impact of Poor Mixing**

When proper mixing procedures are not followed, several issues can arise, compromising the integrity and effectiveness of the refractory lining. Poor mixing results in uneven distribution of components, leading to inconsistent thermal and mechanical properties. Improperly mixed refractories are prone to weak spots and cracks, which can propagate under thermal and mechanical stress. The presence of defects and non-uniformities significantly reduces the lifespan of the refractory lining, increasing maintenance costs and downtime. Additionally, poorly mixed refractories may have inferior insulating properties, leading to higher energy consumption and operating costs. Furthermore, inconsistent or improperly mixed materials are more likely to fail under stress, posing safety risks and potentially leading to costly unplanned outages.

### **The Art and Science of Refractory Mixing**

Proper mixing of refractory materials combines both art and science, playing a critical role in ensuring these materials can withstand extreme temperatures, mechanical stresses, and harsh chemical environments without compromising efficiency. Achieving uniform consistency through careful mixing enhances the thermal properties and operational performance of refractories while also extending equipment lifespan and reducing maintenance costs.

The American Society for Testing and Materials (ASTM) recommends using the Ball-In-Hand test (ASTM C860 – 15) to determine the consistency of refractories. This method identifies the optimal water content and consistency of castable products. To perform the test, form a small ball of refractory mix (2 to 3 inches in diameter) and toss it 12 inches into the air. Observe the condition of the ball as it hits the flat palm of your hand:

- If the ball breaks or shatters, it indicates insufficient water content, making the mix too dry for most applications.
- If the ball flattens out or material oozes between your fingers, it indicates excess water, making the mix too wet for a lot of applications.
- If the ball retains its size and approximate shape, it is suitable for most applications.

The Ball-In-Hand test should be performed after every batch.

A well-mixed refractory mix ensures a homogeneous distribution of components, which is essential for minimizing weak spots and achieving the desired mechanical strength and thermal shock resistance. For example, correct mixing can enhance performance by up to 25%, as indicated by studies, and high-alumina castables that are properly mixed can show up to 15% better resistance to thermal shock compared to poorly mixed counterparts.

Additionally, well-mixed refractories provide better insulating properties, contributing to improved energy efficiency in high-temperature operations, with research showing potential energy savings of up to 10%. By extending the lifespan of refractory linings and improving their performance, proper mixing reduces the frequency of repairs and replacements, leading to substantial cost savings. Improper mixing, conversely, can account for 20-30% of premature failures due to the formation of defects and weak zones. Ultimately, achieving precise mixing ensures more reliable and consistent operation, reducing the risk of unexpected downtime and minimizing associated costs.

### **The Power of Proper Refractory Mixing**

The benefits of proper refractory mixing extend far beyond the immediate aspects of material handling. By embracing the dual principles of art and science, industries can achieve optimal performance, durability, and efficiency in their high-temperature operations. Adhering to best practices in mixing not only enhances the thermal and mechanical properties of refractory materials but also extends their lifespan, improves energy efficiency, and reduces maintenance costs.

Conversely, neglecting proper mixing procedures can lead to significant challenges, including increased repair needs, higher energy consumption, and potential safety risks. Emphasizing meticulous and informed mixing practices ensures more reliable, consistent operation and substantial cost savings, reinforcing the critical role that correct refractory mixing plays in the success and sustainability of industrial processes.

For more information or to talk to a knowledgeable expert with genuine experience, please contact Plibrico at [contact@plibrico.com](mailto:contact@plibrico.com), or 312-337-9000.

You can find additional resource online at [www.plibrico.com](http://www.plibrico.com)

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