

8 KEY EQUIPMENT DECISIONS

# To Perfect Your Dry Mix



# INTRODUCTION

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For dry food mixing, a great mixer is imperative. When your mixer is optimized for your materials, you can benefit from greater efficiency, quality and speed. In this guide, we'll highlight mixers and mixer configurations that are ideal for dry food recipes and premix processing.

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OVERVIEW:

# What is a Dry Food Mix?



# Overview: What is a Dry Food Mix?

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A dry food mix can include many different things. For this guide we'll include dry food mixes for animals, as well as dry mixes for drinks. Though this is not an exhaustive list, engineers and plant managers working with the following premixes may benefit most from this guide:

- ▶ Pancake mix
- ▶ Cake mix
- ▶ Muffin mix
- ▶ Biscuit mix
- ▶ Instant potatoes
- ▶ Dry dip mix
- ▶ Instant oatmeal
- ▶ Gingerbread mix
- ▶ Cornbread mix
- ▶ Drink mix
- ▶ Instant coffee
- ▶ Protein drink mix
- ▶ Nutrient mix
- ▶ Instant soup
- ▶ Non-dairy creamer
- ▶ Mixed powder coatings
- ▶ Tortilla dough dry mix
- ▶ Spice mix
- ▶ Hot Cocoa mix
- ▶ Taco seasoning
- ▶ Grain blends
- ▶ Flour blends
- ▶ Powdered eggs
- ▶ Powdered milk
- ▶ Animal Feed Premix Applications
- ▶ Milk Replacer Powder
- ▶ Trace Minerals for Feed
- ▶ Supplement Premixes

# Ingredient Considerations to Optimize Your Dry Food Mixer



# Ingredient Considerations to Optimize Your Dry Food Mixer

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Different ingredient characteristics will influence which customizations are ideal for your dry food mixer. For example, some ingredients are more sensitive to shear, while others are prone to clump, and shear will be important to break up clumps. For each of the premix ingredients you're mixing, it's helpful to record the following material characteristics:

- ▶ Viscosity: If materials are likely to clump together, stick to the mixer, or flow slowly, this should be recorded. This will be particularly important for dry mixes containing butter, fats, oils, shortening, and similar sticky ingredients.
- ▶ Particle size and variation: It's not essential to have the exact particle size of each ingredient. Most powders have similar particle sizes. However, if one ingredient has significantly different particle size compared to the others, this is important to note. This might be important for mixes with sea salt, for example.
- ▶ Material density: It's helpful to know the approximate material density of each substance you're working with, as this can affect how large the mixer should be and how much it can mix at one time. This might be important for mixes containing different types of flour, for example.
- ▶ Shear sensitivity: If some ingredients are susceptible to shear and are likely to break apart in the mixer (and aren't supposed to), this is important to note. This might be important for spice mixes containing peppercorns, for example.
- ▶ Abrasion: Premix materials that are more abrasive will need extra considerations to preserve the life of the mixer, agitator and motor. This can be important for mixes with high salt content, for example.



# Designing the Mixer





# Designing the Mixer: Type

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There are many different types of mixers. Different mixers may use different methods to properly blend premix materials, such as air, gravity, rotation, agitation, emulsification, static, whipping, blending, beating, folding, and more. The most common types of commercial mixers for dry food mixes are ribbon mixers, double ribbon mixers, and paddle mixers.

- ▶ Ribbon mixers: A ribbon mixer uses two long, thin, stripes of metal, supported by metal spokes, twisting around each other. This looks similar to a DNA helix, with one helix inside the other. This moves material in opposing directions through the mixer to achieve a cohesive mix in a relatively short amount of time.
- ▶ Double ribbons mixers: A double ribbon mixer uses a double helix inside another double helix, with four total ribbons mixing materials. This mixer blends materials faster than a traditional ribbon mixer, though it is also heavier, more complex, requires a more powerful motor, and is more expensive.
- ▶ Paddle mixers: A paddle mixer uses flat paddles instead of thin ribbons to mix material. This mixer is slower and gentler. It's most commonly used for wet mixes, such as salsa, potato salad, salad dressing, or meat mixes. It may also be used for some dry food mixes with various particle sizes, like some spice mixes or snack food mixes.

# Designing the Mixer: Size and Dimensions

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One of the most important considerations for getting a cohesive, uniform premix is to choose the right mixer size and type. Dry food mixers can mix as much as 14 tons of material at one time. However, most mixers are smaller, generally 5 tons. A 5 ton mixer is usually 6.8 ft wide, 7.5 ft tall, and 12 feet long. Within this range, the mixer may also be taller, wider, or shorter, depending on the setting the mixer must fit into, as well as the materials you're working with.

- ▶ Mixer capacity: Mixers of different sizes will be able to mix different amounts of ingredients at one time. The mixer's capacity should coordinate with the weighing system, feeder, and discharge system. If the mixer works too quickly or too slowly compared to the surrounding equipment, it will slow the overall process down.
- ▶ Mixer width: Mixers with more complex agitators, like a double ribbon mixer or a paddle mixer, will be slightly wider. When working with these mixers, it's important to be sure the mixer will fit safely in the facility.
- ▶ Mixer height: There are several considerations for mixer height, including how the mixer is filled and discharged. Filling from the top and discharging from the bottom is the easiest way to design the mixer, though exceptions are possible when working with limited vertical space.
- ▶ Mixer length: The right mixer length is essential to achieve a complete mix. If the mixer isn't long enough, the materials can't move enough to be cohesively mixed. If space is limited, additional mixers, each with smaller capacities, can solve this problem.

# Designing the Mixer: High Shear Agitators

High shear agitators, also called choppers, can be added to the mixer to increase shear throughout the mixer. These agitators are bits of metal fixed to the mixer that will provide additional blending power. High shear agitators are not a common addition to dry food mixers, but can be very useful in some situations. For premixes containing shortening, fat, oils, or other materials that might make the mix prone to sticking, high shear agitators can help to break up clumps. Or, if the dry mix contains materials with varying particle sizes that must be broken up, a high shear agitator may be helpful.



# Designing the Mixer: Tolerance

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The mixer's tolerance assesses the space between the agitator and the mixer profile. In most cases, a tight tolerance is ideal. Mixers with tight tolerances are easier to discharge, since material won't sit in the areas between the agitator and the mixer. Mixers with tight tolerances are also easier to clean. However, tight tolerances also have high shear, which can be problematic for mixes sensitive to shear, or those with high particle size variation.

- ▶ Tighter tolerance: Coordinating the size of the agitator and the mixer can help to decrease the tolerance. In some cases, adding a liner to the mixer can create a tighter tolerance. (we'll discuss this more in the next section)
- ▶ Larger tolerance: It's possible to increase the tolerance by using a smaller agitator or shaft within the mixer. This will reduce shear and can help to keep larger particles intact.

Reinforcement



# Reinforcement: Liners

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Some premix materials will put more stress on the mixer and agitator than others. Recipes with higher salt content or acidity, as well as more abrasive materials, will create more wear. Reinforcement can prevent the mixer from breaking down prematurely when working with these materials. Liners are one type of reinforcement. Liners might be made from ceramic materials or plastic, particularly ultra high molecular weight (UHMW) polyethylene. Liners have some drawbacks as well, however; they can be harder to clean and they can absorb colors and odors from some materials.





# Reinforcement: Construction

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Food-grade mixers are generally made from 3/16" or 1/4" hot rolled carbon steel. However, choosing a different grade of stainless steel can increase the durability of the mixer. In addition, the mixer can be reinforced with thicker metal and sturdier welds. Food grade mixers will always be made with food-grade welding standards, and can be reinforced to prevent wear from breaking down the welding points. Premixes for animal feed may use a different grade of stainless steel as well.

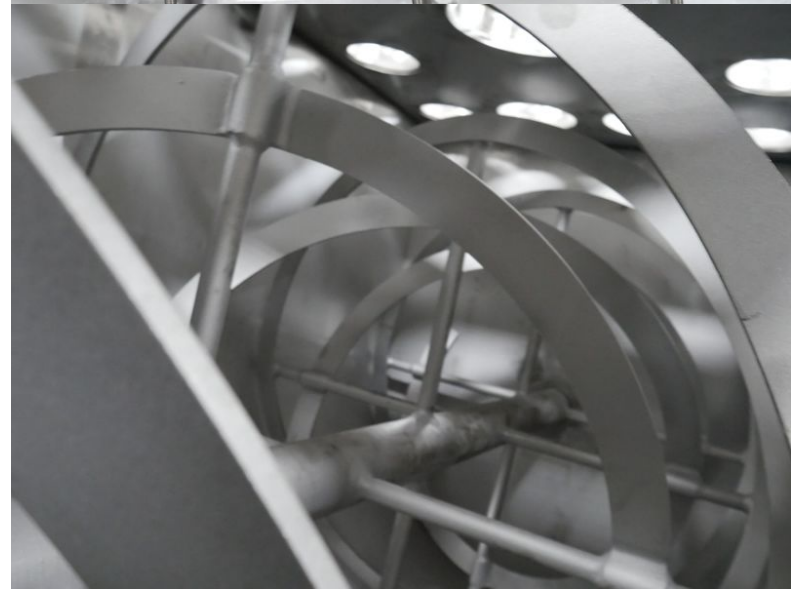




# Reinforcement: Heat Treatment

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The spiral agitators in a ribbon mixer are made by stretching a solid metal piece. This can make the ribbon susceptible to damage due to stress, like starting the mixer under load. While it's advisable not to start the mixer under load, it must be done in some cases. In these cases, the ribbon should be heat treated to prevent stress fractures.



Seals



# Seals: Design

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The seals on either end of the shaft are essential. There are several different ways to design a seal. Each of these seals must keep fine powders contained, without preventing the shaft from moving. These seals must also be easy to clean and they must not trap powders, or these could fester and become a food safety risk.

- ▶ Air seal: These seals use directional flow paths to create pressure and velocity that prevents dust from escaping. This is one of the most effective seals from dry food mixing.
- ▶ Mechanical seal: These seals use two parts to create a very small space and a restrictive flow path that prevents small particles from escaping.
- ▶ Inflatable seal: An inflatable seal uses an inflatable rubber mechanism to restrict the space between the mixer and the shaft and prevent dust from escaping.

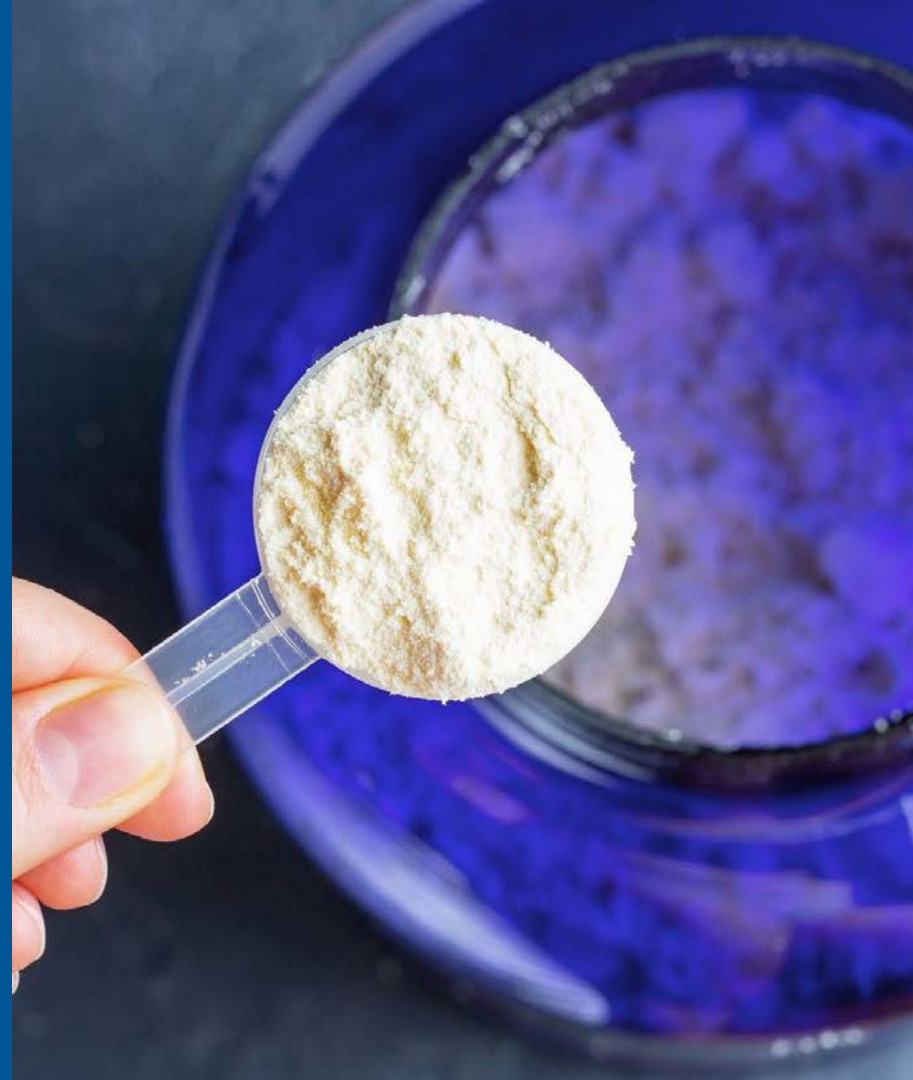
# Seals: Packing

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The packing around the seal is an essential part of maintaining the mixer. The packing around the seal may be made from a neoprene or teflon-infused rope. Periodically, this packing must be replaced to properly maintain the seal and the mixer itself. By regularly scheduling time to maintain the seal, including the packing, you can extend the life of the mixer substantially and make sure it's in full working order.



# Discharge Gate



# Discharge Gate: Type

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The discharge gate determines how the premix material moves along to the next step in the process. There are several types of discharge gates. The placement and number of gates can also be customized, which we'll discuss more in the next section.

- ▶ Drop-bottom: A drop bottom discharge gate allows all the material in the to leave at one time. These can operate very quickly, but it can be more difficult to contain the dust or fugitive particles.
- ▶ Butterfly gate: A butterfly gate turns to the side to release the material. This type of gate is most common in the food industry since it's easy to seal and it's highly sanitary.
- ▶ Slide gate: A slide gate operates as the name implies, by sliding to the side to release material. This type of gate can release material quickly, but fine particles can easily get stuck.

# Discharge Gate: Placement

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The discharge gate can be placed in different areas across the mixer. The discharge gate can be placed at either end of the mixer, in the center, or at both ends, when using two discharge gates.

- ▶ Multiple discharge gates: With multiple discharge gates, material can be released faster. However, this can result in small voids within the mixer where premix material can become stuck.
- ▶ Center discharge gate: To discharge material in the center of the mixer, the mixer agitators will need to be designed differently, so the material can move more quickly to the center.
- ▶ One end discharge gate: One discharge gate at one end of the mixer will discharge material more slowly, but this may make the material easier to control, especially for very fine powders.



# OPTIMIZE YOUR MIXER

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When your mixer works fast, works with your premix materials, and is made to last, your operation will be more efficient and more cost-effective. Talk with the experts in dry food mixing to optimize your mixer and your entire dry food mixing operation.

Talk With the Experts Today!



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