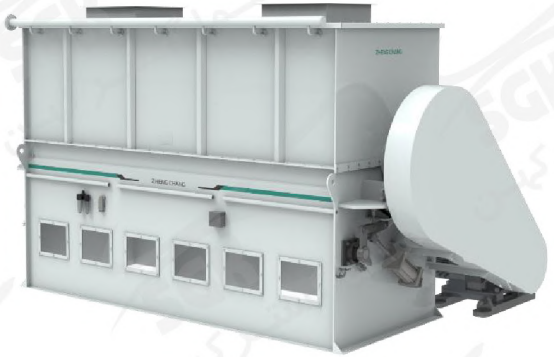
正昌粮机股份
ZHENGCHANG CEREAL AND FEED MACHINERY



Zhengchang High-efficiency Mixer

Stability and Reliability Help Achieve Long-term Development

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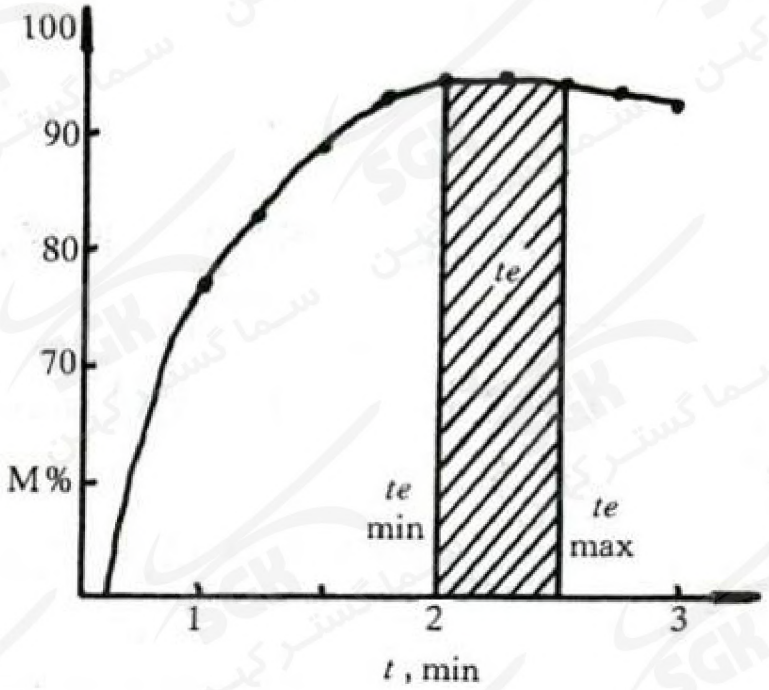
Mixing Purpose

Mixing is a means to distribute the solid and liquid raw materials put into the mixing chamber according to the formula evenly throughout the mixing chamber through a certain physical movement within a certain period of time. It is a means to achieve the formula nutrient ratio in feed production.




Mixing Principle

Mixing Speed Characteristic Curve



M - mixing degree % t - mixing time min

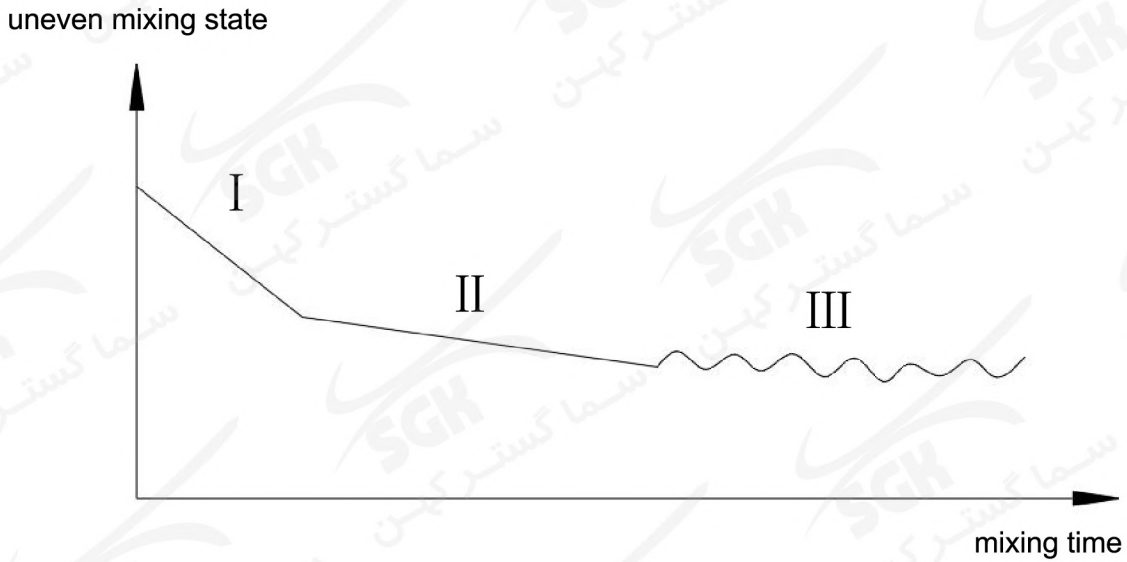
Mixing Principle:

It is the process of uniformly distributing the particles of various components in a mixture composed of various raw materials under the action of external force. Studies have shown that as the mixing time increases during the mixing process, the mixing degree and mixing effect will increase rapidly and reach the best uniform mixing state. This state is called "dynamic equilibrium state". If you continue to extend the mixing time, there will be a tendency to separate, and the uniformity of mixing will decrease instead. This phenomenon is called over-mixing, and the mixing effect becomes poor. So there is different optimal mixing time for different raw materials and different mixers.

Mixing Elements

Mixing elements: shearing, convection, diffusion, striking, grinding

(main mixing effect)



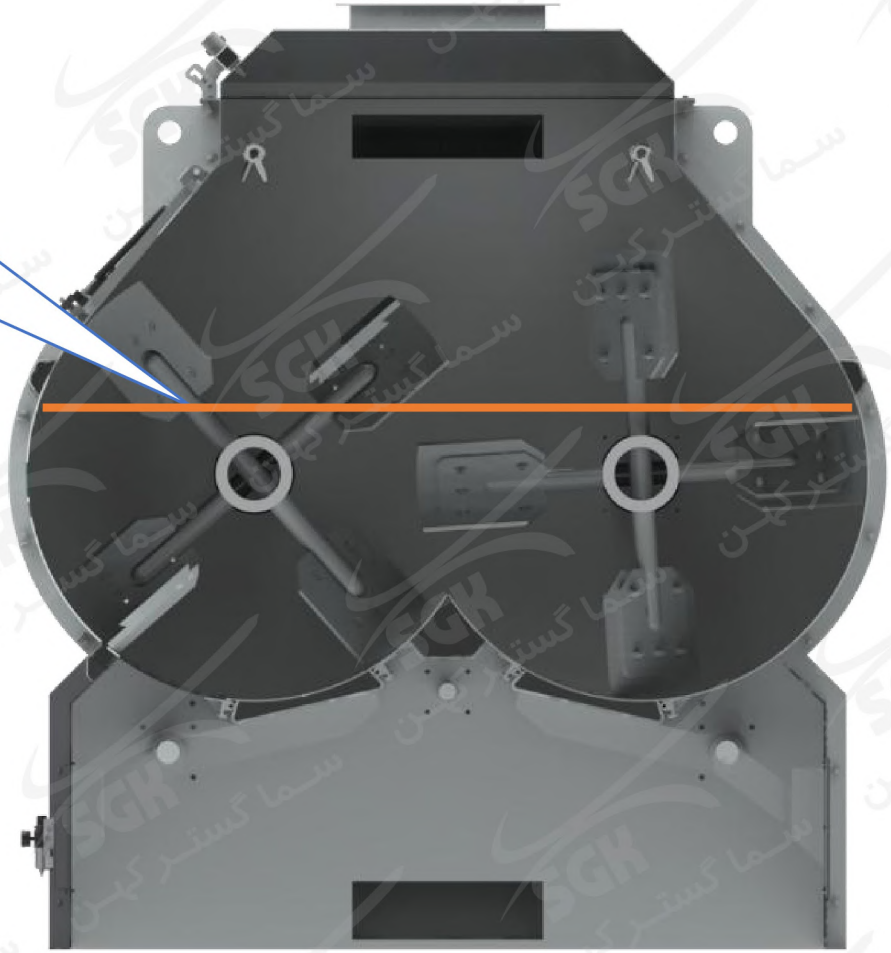
In the early stage of mixing, the curve drops with a large slope, indicating that the uniformity of the material is improving rapidly, and it is in the first stage of mixing (I). At this stage, convective mixing plays a major role, making the material quickly from inhomogeneous to roughly uniform. The speed of this process is mainly determined by the components of the mixing equipment. As time goes by, the mixing enters the second stage (II), the convective mixing effect gradually weakens, and the diffusion mixing and shear mixing effects gradually strengthen, making the mixing more uniform. The mixing at this stage mainly depends on the physical properties of the material, the proportion of the components, the particle size of each component and the surface properties of the components. Entering the third stage (III), with the progress of mixing, segregation always exists, and further action makes mixing and segregation reach a dynamic balance, and the mixing uniformity fluctuates within a certain range over time.

Factors Affecting Mixing Effects

1. Physical properties of the mixture (viscosity, density, particle size, roughness, etc.)
2. Mixer speed (best speed design)
3. Mixing time (feeding + dry mixing + liquid spraying + wet mixing + unloading)
4. Filling coefficient (the ratio of the volume of the loaded material to the effective volume of the mixer)
5. Feeding sequence (proportion, particle size - first large and then small, bulk density - first small and then large)
6. Residue rate (Cross-contamination)

Filling Coefficient

The best filling position for materials is slightly higher than the main shaft, accounting for about 2/3 of the total volume in the mixing chamber.



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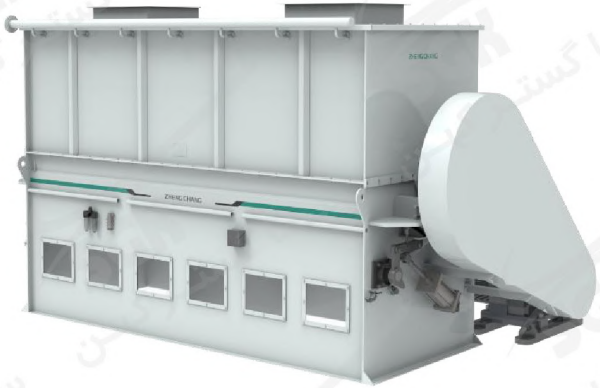
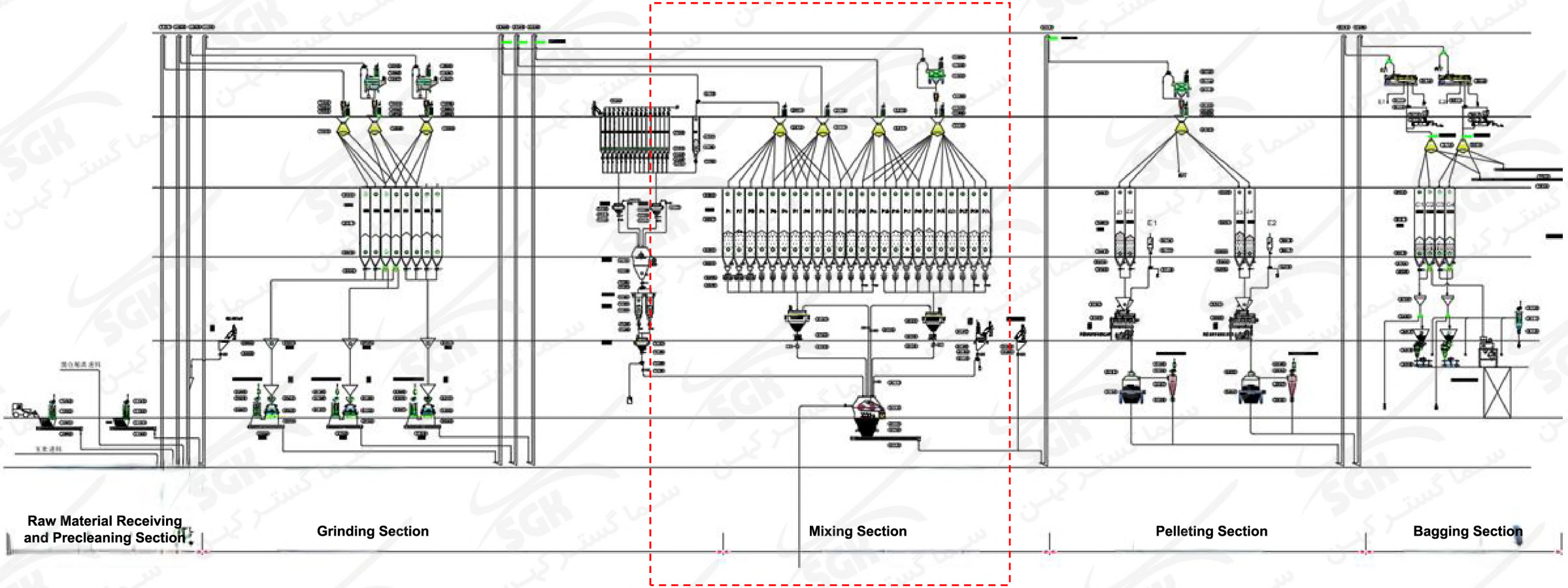
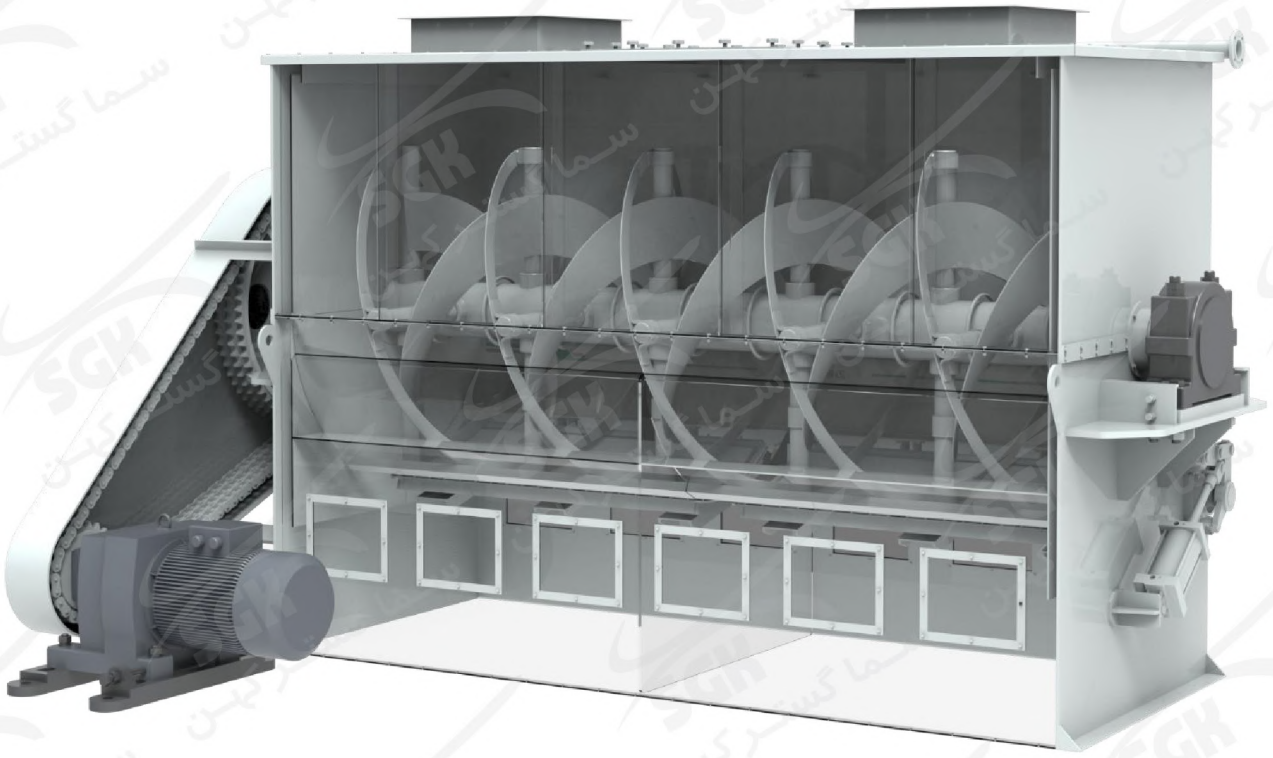
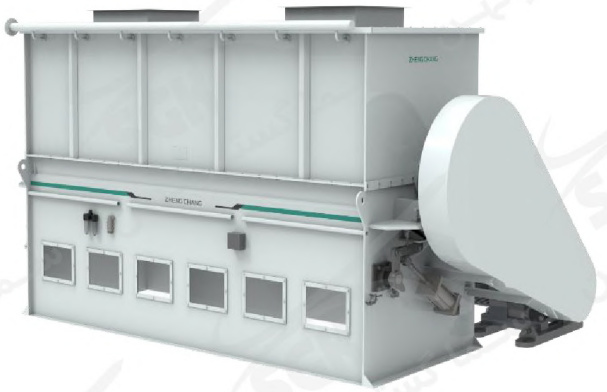
Main Mixer Models




Raw Material Receiving and Precleaning Section
Grinding Section
Mixing Section
Pelleting Section
Bagging Section

Ribbon Mixer





Due to the characteristics of continuous spiral blades, it is more suitable for materials with certain viscosity or relatively more fibrous materials with relatively poor fluidity and low uniformity requirements, such as cattle and sheep feed with molasses added.

Ribbon Mixer

Model	Effective Volume	Mixing Amount Per Batch	Mixing Time Per Batch	Mixing Uniformity	Power
SLHY0.4	0.4m³	200kg	3～6min	CV≤7%	4KW
SLHY0.6	0.6m³	300kg	3～6min	CV≤7%	5.5KW
SLHY1	1m³	500kg	3～6min	CV≤7%	11KW
SLHY2.5	2.5m³	1000kg	3～6min	CV≤7%	18.5KW
SLHY5	5m³	2000kg	3～6min	CV≤7%	30KW
SLHY7.5	7.5m³	3000kg	3～6min	CV≤7%	37KW
SLHY10	10m³	4000kg	3～6min	CV≤7%	45KW
SLHY12	12m³	5000kg	3～6min	CV≤7%	75KW

Single Shaft Mixer

It is generally used for the mixing of premix, with high mixing uniformity, low residue rate and good sealing performance. It is more suitable for materials with finer particles such as premix. The contact part between the mixer and the premix should be made of stainless steel; when the bulk density of the premix is large, it is necessary to make corresponding adjustments to the power, main shaft, struts, blades and other parts of the mixer according to the actual situation.

Single Shaft Mixer

Model	Effective Volume	Mixing Amount Per Batch	Mixing Time Per Batch	Mixing Uniformity	Power
SDHY0.2	0.2m³	100kg	60～180s	CV≤5%	3KW
SDHZ0.5	0.5m³	200kg	60～180s	CV≤5%	7.5KW
SDHZ1	1m³	500kg	60～180s	CV≤5%	15KW
SDHZ2	2m³	1000kg	60～180s	CV≤5%	18.5KW
SDHZ3	3m³	1500kg	60～180s	CV≤5%	22KW
SDHZ4	4m³	2000kg	60～180s	CV≤5%	30KW
SDHZ6	6m³	3000kg	60～180s	CV≤5%	30KW×2
SDHZ10	10m³	5000kg	60～180s	CV≤5%	37KW×2
SDHZ12	12m³	6000kg	60～180s	CV≤5%	45KW×2

Double Shaft Mixer

The double shaft mixer is weightless mixing, which is relatively less affected by material differences. It is the most widely used in the industry, and is more suitable for mixing various types of livestock, poultry, and aquatic feed; when used for materials with large bulk density, and the large amount of liquid added will lead to an increase in the viscosity of the material, and it is necessary to adjust the power, main shaft, struts, blades, etc. of the mixer according to the actual situation.

Double Shaft Mixer

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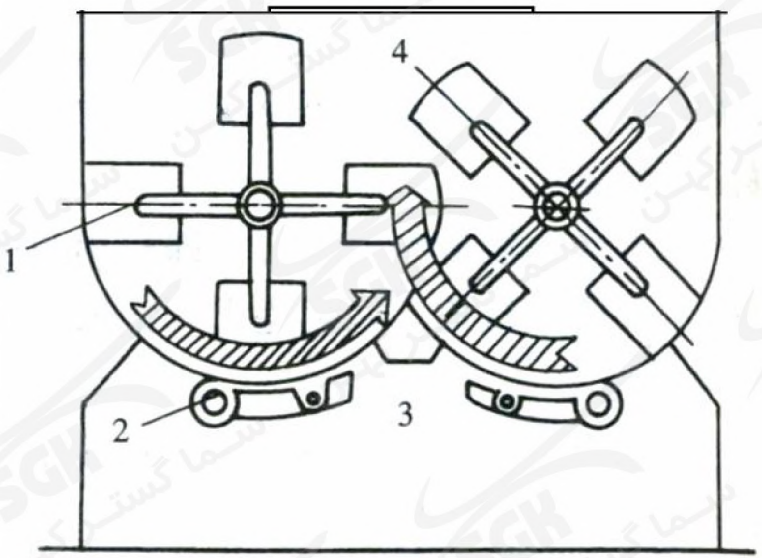
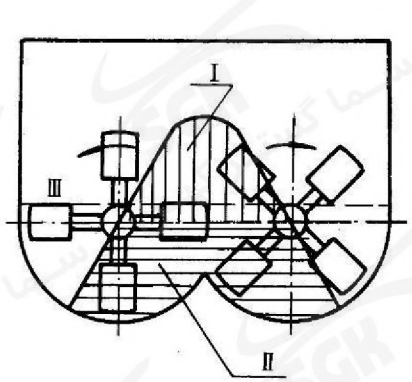
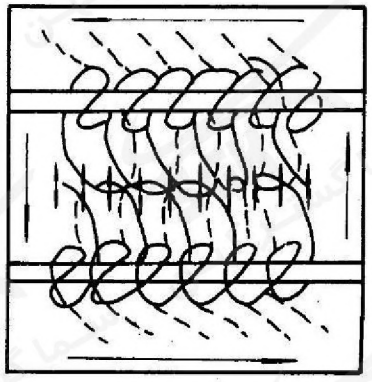
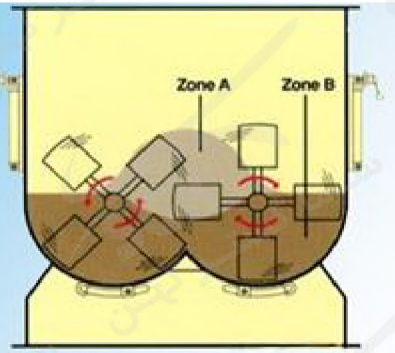
Model	Effective Volume	Mixing Amount Per Batch	Mixing Time Per Batch	Mixing Uniformity	Power
SSHL0.5	0.5m³	250kg	30～120s	CV≤5%	7.5KW
SSHL1	1m³	500kg	30～120s	CV≤5%	15KW
SSHL2	2m³	1000kg	30～120s	CV≤5%	18.5KW
SSHJ3	3m³	1500kg	30～120s	CV≤5%	22KW
SSHL4	4m³	2000kg	30～120s	CV≤5%	30KW
SSHS4	4m³	2000kg	30～120s	CV≤5%	22KW
SSHL6	6m³	3000kg	30～120s	CV≤5%	37KW
SSHS6	6m³	3000kg	30～120s	CV≤5%	37KW
SSHS8	8m³	4000kg	30～120s	CV≤5%	22KW×2
SSHS10	10m³	5000kg	30～120s	CV≤5%	30KW×2
SSHS12	12m³	6000kg	30～120s	CV≤5%	37KW×2

Mixing Principle of Double Shaft Mixer

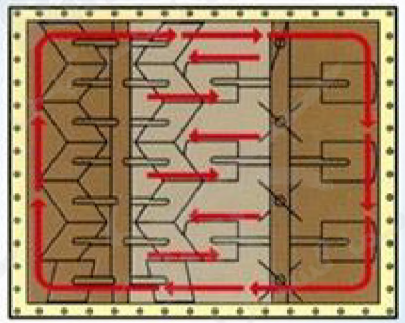








working principle



working principle

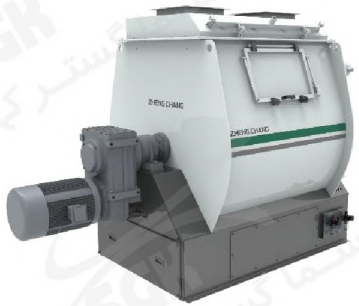
mixing start

10 seconds later

20 seconds later

30 seconds later

Comparison of Three Types of Mixers



	Ribbon Mixer	Single Shaft Mixer	Double Shaft Mixer	Comparison	Special Note
mixing uniformity	≤7%	≤5%	≤5%	The mixing uniformity of single shaft mixer and double shaft mixer is higher than that of ribbon mixer.	The mixing uniformity of the premix depends on the characteristics of the material and the difference in the formula, which is obtained through actual testing.
residue rate	≤0.8%	≤0.3%	≤0.5%	The single shaft mixer has few but adjustable paddles, and the full-length cavity has a large door opening, so the residue rate is the lowest.	When used for mixing premix, a compressed air injection system is required to minimize the residue in the cavity and prevent cross-contamination to the greatest extent.
mixing time	3～6min	60～180s	30～120s	The double shaft mixer is weightless mixing, so the mixing time is the shortest.	When the single shaft mixer is used for mixing premix, the mixing time should be determined according to the actual material.
filling coefficient	0.6～0.8	0.4～1	0.4～1.4	Due to the different mixing methods, the variable range of the filling coefficient of the double shaft mixer is the largest.	The mixing effect reach best when the filling coefficient is 1.0.
Shaft End Sealing Method	outer packing inner felt	packing + air ring	packing	The shaft end sealing effect of the single shaft mixer is the best.	When the single shaft mixer is used for mixing premix, it is necessary to add an air ring seal to prevent material leakage at the shaft end.
Discharge Door Sealing Method	adjustable silicone seal	adjustable silicone seal	adjustable silicone seal	same method of sealing	The sealing effect of silicone with a Shore hardness of about 40° is the best.

When it is used in premix, layer feeds, etc. that containing raw materials with large bulk density, or cattle and sheep feeds with more fibrous substances, and when the viscosity of the materials increases due to the large amount of liquid added, it is necessary to enlarge or thicken the power, main shaft, struts, blades, machine slots of the mixer according to the actual situation.

Mixing Uniformity

CV: ***C****oefficient of* ***V****ariation*

The CV value reflects the absolute value of the degree of dispersion of the data.

For example: CV≤5% means mixing uniformity ≥95%

Basic Test Methods:

a. Chloride ion method (salt method or chloride ion contained in the formula)
b. Iron ion method (iron ion contained in the formula)
c. Methyl violet method (methyl violet: tracer, dye)

Standards followed:

"GB/T 32536-2016 Feed Mixer Test Method"
"GB/T 5918-2008 Determination of Mixing Uniformity of Feed Products"
"GB/T 10649-2008 Determination of Mixing Uniformity of Microelement Premix"

Mixing Uniformity Test Method

1. Test materials:

A. Corn flour

The second-class and above corn that conforms to GB/T17890 is processed by grinding. The grinded particle size is 100% passing through the test screener with a basic screen hole size of 2.0mm. There must be no whole corn. The materials on a test screener with a basic size of 0.85mm is not more than 5%, and the moisture content is not more than 14%.

Methyl violet or sodium chloride can be used as a tracer, the amount of methyl violet added is 1/100,000 of the batch mixing amount, and the amount of sodium chloride added is 2% of the batch mixing amount.

B. Production test materials

When using production materials for testing, the characteristics of the materials such as variety, composition, bulk density, moisture, and particle size should be recorded.

Iron ions or chloride ions in the material can be used as a tracer, or methyl violet can be added as a tracer.

Mixing Uniformity Test Method

2. Test method:

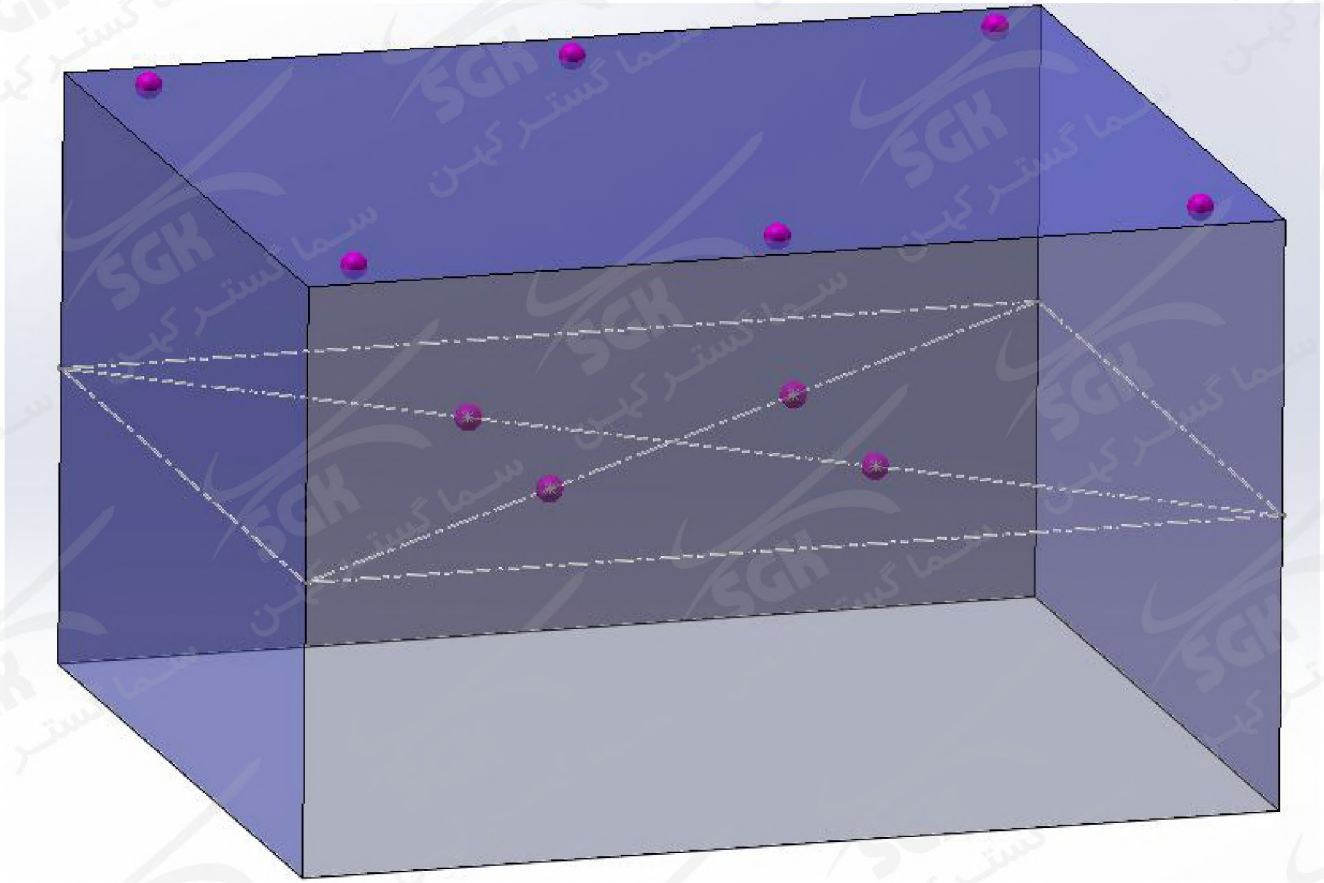
Start the mixer with no load first, and start adding the test materials after confirming that the mixer is running normally. If the tracer is methyl violet, after the test materials are added, the methyl violet should be coated with an appropriate amount of corn flour, and then added at the manual inlet at one time.

3. Sampling:

When using the test material of the standard formula for the test, start timing from the tracer, and stop sampling when the mixer runs to the specified mixing time or the best mixing time obtained from the test.

After shutdown, the discharge door should be closed. Then open the cleaning door, and use a sampler to take 10 samples inside the mixer, each sample about 100g ~ 150g. No stirring is allowed during sampling.

Mixing Uniformity Test Method



sampling points inside the mixer

Mixing Uniformity Test Method

4. Determination of mixing uniformity

According to the type of tracer in the obtained sample, choose GB/T5918 or GB/T10649 standard to measure the CV value of mixing uniformity. (The difference in tracer content in different samples of the same batch of materials reflects the mixing uniformity of the materials)

5. The best mixing time

The mixer charge amount is the rated batch charge amount. When the standard test material is used, start timing from the time when the tracer is added, mix until the machine is shut down for 30 seconds to take the first sampling, and then take a sample every 15 seconds, for a total of 10 shutdowns, and 10 samples are taken at each time point. When production materials are used, start timing from the addition of materials.

Detect the CV value of the samples taken at each time point, and draw a graph with CV and mixing time as the coordinate axis. From the beginning, as the mixing time prolongs, the CV will change from large to small. When the CV changes of three adjacent time points are CVn-1 > CVn <CVn+1 for the first time, the cumulative mixing time of n time points is the best mixing time for the mixer to obtain the minimum CV value.

Mixing Uniformity

Special Note:

Not all materials with different formulas can achieve ideal mixing uniformity. The closer the difference in bulk density and particle size between different formulas in the materials and the better the fluidity of the materials, the better the mixing uniformity.

The mixing uniformity CV of the premix should be ≤5%. However, the formulas of the premix are various and have great differences. Therefore, it is very important for the feed plant to choose the formula of the premix reasonably. The different materials should not have too much difference, otherwise it will be difficult to ensure the mixing uniformity of the premix.

Mixer for Mixing premix

Mixing of Premix

- Compound Feed
  - Energy Feed
  - Concentrated Feed or Protein Supplement
    - Protein Feed
    - **Premix**
      - Carrier
      - Feed Additive Raw Material
        - Nutritional Additives
        - Non-nutritive Additives

The full name of premix is additive premixed feed, which refers to the uniform mixture prepared by two or more feed additive carriers or diluents in a certain proportion, and the proportion in the compound feed is generally 0.5% to 5%. Premix is the core of compound feed. Although the dosage is small, it has a great effect on the improvement of animal production performance, the improvement of feed conversion rate and the preservation of feed.

A good quality premix contains 6 or 7 kinds of microelements, more than 15 kinds of vitamins, 2 kinds of amino acids, 1 or 2 kinds of antioxidants or antifungal agents. The premix additives have a high content of active ingredients and require a relatively stable mixing environment, so the premix mixer must be made of stainless steel (the part that in contact with the material should be made of stainless steel).

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Thank You!

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