

AVA Vertical or Horizontal Mixers-Dryers for Batch or Continuous Operations

Efficient production processes through process engineering expertise

Introduction

The mixing process is one of the fundamental processes in solids process engineering. Over time, the trend has developed to use the mixers not only for the homogenization of powders and / or granules, but also the adjacent processes and process steps:

- **Mixing**
- **Humidifying**
- **Drying**
- **Cooling**
- **Stripping**
- **Reacting**
- **Coating**
- **Heating**
- **Homogenizing**
- **Crystallizing**
- **Wetting**
- **Solidifying**
- **Extracting**
- **Disagglomerating**
- **Evaporating**
- **Granulating**

The goal is to accomplish as many processes as possible in one unit in order to minimize investment and process costs. Due to this development, mixers have increasingly developed into multipurpose process machines, underscoring their importance as a central element in the systems. Depending on the structure of the production process, a distinction is made between batch mixers and continuously operating mixers. The three types of mixers, which cover the vast majority of the application spectrum of the powder and granule processing industry, are explained below in terms of their optimal application options:

- Conical mixers-dryers for batch operation
- Horizontal mixers-dryers for batch operation
- Horizontal mixers-dryers for continuous operation

Vertical Batch Mixers - Dryers

The vertical batch mixers-dryers of AVA, Figure 1, are made up of a conical vessel with a short cylindrical container part following it. Depending on the application, the mixer is closed with a dished head or a flat lid at the top. The mixer consists of a conical mixing helix, which is welded via webs with a centrally arranged shaft. Large radii at the welds and round bars allow a good cleanability. The mixer is mounted on top of the cover which avoids product-contacted shaft seals. Thanks to the storage and the seal outside the product space, contamination of the product is eliminated.

Depending on the application, feed and cleaning nozzles, measuring instruments and vapor filters are also located on the vessel head. After the mixing or drying process the product is discharged via a large emptying opening in the vessel bottom. The conical shape ensures maximum discharge of the solids - an essential aspect in the handling of bulk material.

The vertical mixer is widely used, for example, in the pharmaceutical industry, where cleanability is an important parameter as well as avoiding cross-contamination. The AVA vertical mixer-dryer is used for APIs (Active Pharmaceutical Ingredients).

BHS-Sonthofen Inc. & AVA-GmbH **[Part of the BHS Group of Companies]**

Often, APIs are sensitive to mechanical stress and heat. The conical mixing helix distributes the mechanical stress and heating uniformly in the product resulting in no hot-spots. This means that the mixer can be operated efficiently with the highest possible energy input without causing harmful stress peaks. Thanks to the large heating surface via the heated jacket and the optionally heatable shaft and coil, optimum heat transfer is achieved, which heats the product quickly and evenly.

After the process, the product is discharged via a cleanable ball valve or knife-gate valve. To prevent cross-contamination, for example, CIP cleaning nozzles ensure that the entire interior and/or the vapor dust filter housing are operated when the machine is closed. With GMP versions and the use of FDA-validated, materials and seals, the highest production reliability is guaranteed.

The vertical batch mixers are also used for the processing of other, mostly high quality products, such as catalyst materials and metal powders.

Horizontal Mixers-Dryers for Batch and Continuous Operation

The AVA horizontal mixers-dryers, Figures 2 and 3, consist of a horizontal cylindrical vessel, which is closed on both sides by flat plates, the head plates. A horizontally arranged, usually double-side agitator is located in the mixing vessel. It consists of a series of wall-mounted mixing elements, which are connected with a shaft via arms. For special applications, the horizontal mixers can be realized in a single-side bearing design. The laterally arranged head pieces not only form the end of the product space to the environment, but also serve to support the mixing vessel as well as the shaft seal and shaft bearing. Integrated inspection flaps ensure easy accessibility for cleaning, inspection and maintenance. The mixer-dryer is driven by a geared motor, which is separated by a shaft compensation clutch and arranged on a separate enclosure while for smaller equipment it is mounted directly onto the shaft.

The horizontal mixers-dryers are designed for flexible operation for each application, are very robust particularly with double-side bearings.

The horizontal mixers – dryers are characterized by extremely short mixing or residence times with high mixing quality and efficient energy usage. This is achieved on the one hand by the special arrangement of the mixing elements, which provide a forced transport of the mixed material and on the other, by the special shape of the AVA blades, which are a significant improvement over the conventional ploughshare blades. The AVA blades have a larger active tool surface area with much lower energy consumption as the mixers – dryers operate in the turbulent areas of mixing.

Horizontal batch mixers – dryers are designed for extremely high energy intensity. The mixing tools are protected against wear with specially coated tungsten carbide blades, shown in Figure 4.

Smaller mixers are often used in multi-purpose chemical and specialty pigment production, where flexible color and formulation changes and easy cleanability are required. The large mixers are ideal for the production of a range of commodity products such as metal ores, starches and cellulose materials (MC, HEC, etc.) For specialty reactor applications, designs are up to 21 bar in various alloys for corrosive materials are available.

BHS-Sonthofen Inc. & AVA-GmbH **[Part of the BHS Group of Companies]**

In the version as a continuous mixer-dryer, the product is added in the first one-third (1/3) of the drum via nozzles and discharged on the output side. This can alternatively be done via a product discharge in the drum base or frontally special height with adjustable weirs. The mixing or drying result can be set directly via the average residence time in the product space in combination with the mixer design.

In most continuous production processes, continuous mixers can often be used very efficiently. An optimally designed continuous machine usually replaces 2-3 batch mixers of comparable size in these processes, which means considerable savings in space requirements and investment/operating costs.

For example, in the production of modified starch, conventional vertical batch mixers are used as reactors. At a desired throughput of 2 tons/hour and a residence time of 2 hours in the reactor, at least 2 – 3 reactors in the range of 10 m³ are needed in order to be usefully integrated into the continuous process. Reaction times and conditions can be guaranteed to the same extent in a one continuous horizontal reactor. Further application examples include mixing of superabsorbent materials with additives; food, specialty chemicals and special waste materials to improve the operating of rotary kilns.

Conclusion

The choice of vertical or horizontal designs for batch or continuous operations requires careful analysis of the process and the bulk material. The machines must be adapted exactly to the respective requirements and raw material properties. In tests at the AVA technical center each individual application can be tested on both horizontal and vertical systems in order to develop the best possible configuration for the user. In-house knowledge databases, many years of process know-how and continuous product development are the most important prerequisites for meeting the requirements of the market.

BHS-Sonthofen Inc. and AVA-GmbH are wholly-owned subsidiaries of BHS-Sonthofen GmbH and part of the BHS group of companies. The BHS filtration technologies provide for thin-cake (3 mm - 25 mm) filtration, cake washing and dewatering based upon pressure or vacuum, for batch or continuous operations from high solids slurries (up to 50% solids) to clarification applications with solids to 1% and less (trace amounts). The AVA technologies provide for turbulent mixing, reacting and drying of wet cakes as well as powders and process slurries. The vertical and horizontal technologies are vacuum or atmospheric, batch and continuous, for final drying to “bone-dry” powders.

Filtration and drying tests are conducted on-site or in the BHS test labs in Charlotte, North Carolina or AVA test center in Herrsching (Munich), Germany. The BHS drying test center will be available in 3Q 2019. For further information, please contact Barry A. Perlmutter, President & Managing Director of BHS-Sonthofen Inc. at 704.845.1190 or via e-mail at info@bhs-filtration.com. Information can also be found at www.bhs-filtration.com or <https://www.ava-huep.com/en/>.

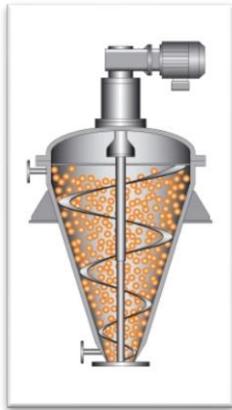


Figure 1: Vertical Cone Mixer

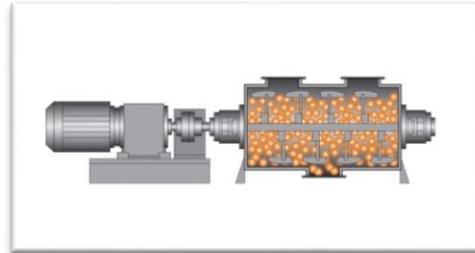


Figure 2: Horizontal Batch Mixer

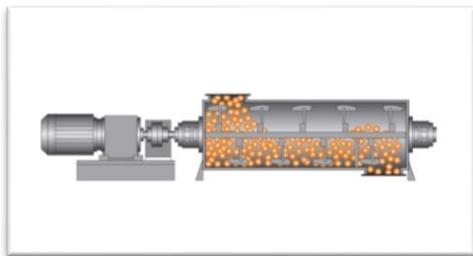


Figure 3: AVA Horizontal Continuous Mixer with Bottom Discharge



Figure 4: AVA Heavy-Duty Blades with Tungsten Carbide Coating