



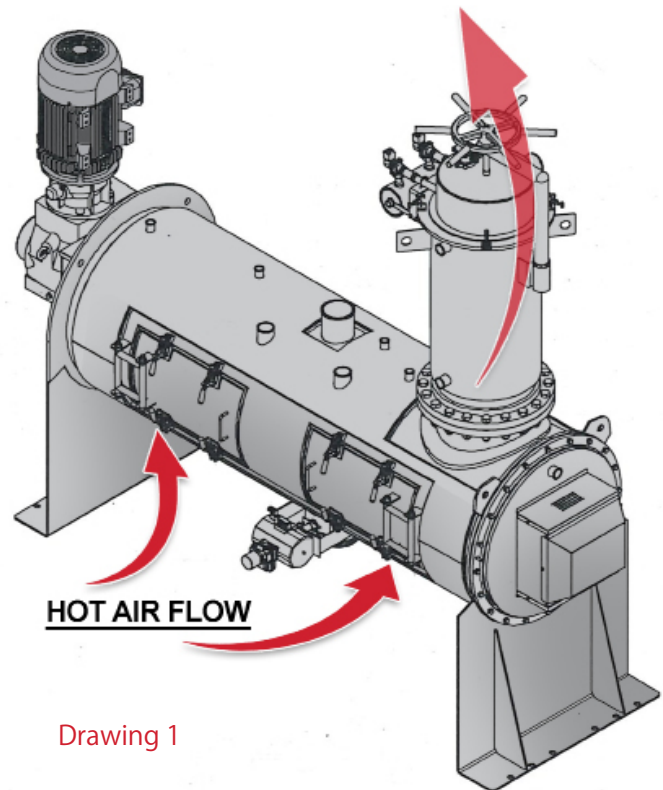
**PROCESSALL**

# Air Drying Plow Mixers

Drying touches many aspects of chemical manufacturing. Whether it be food production, pharmaceutical manufacturing, or even processes in the agrochemical industry, drying technologies are a vital part of the chemical production industry. This is because many chemical processes result in the formation of a wet filter cake. This cake typically must be purified and cleansed before it is sold to customers.

The initial precipitates are often full of impurities that form during reactions and these contaminants need to be removed following the filtration processes. The unrefined filter cake is often then exposed to several purification steps. Often the material is washed with different solvents to remove any excess byproducts or unreacted materials from the product. These solvents range from a wide variety of organic solvents to water most often. After the purification stage is completed, many companies are then left with a solvent ridden material that needs to be dried. There exist a wide variety of drying techniques on the market like air driers, microwave driers, radiant heat driers and vacuum driers.

However, few offer the speed, particulate size control, and customization features of plowshare driers. Plow share drying can be done in two distinctly different methods of drying. They are vacuum drying and air drying. While similar in structures of the driers the principles by which they dry the particles differs greatly as well as the applications that use them differ as well. Plow share Vacuum Drying relies on lowering the pressure in the unit and the evaporation occurring on the heated jacket. This style of evaporations is referred to as nonadiabatic drying. Air drying plowing mixers on the other hand have warm air injected into the vessel to pass over the materials being dried. This style of drying is more commonly referred to as adiabatic drying. See drawing 1 for a diagram of air drying.



Drawing 1

The location of plowshare air dryer's drying chamber is the cylinder located on its side with a central shaft having mixing elements or Plows. The spinning of this shaft and plows creates a mechanically fluid bed from the mixing action. This is because of the high horsepower motors used on plow mixers. The mixing action creates a maximum heat transfer rate from the hot air in the system and the product. The spinning action of the plow enables particles inside the vessel to maximize surface contact with the injected hot air in the system. This circulating material maximizes the ratio of the particles to air enabling faster drying times of material than static air-drying systems.



# Air Drying Plow Mixers

All the work to achieve vaporization of the solvent is done by heating the injected air into the drum to achieve the desired temperatures needed to achieve vaporization. The air injected into the drier is 100% dry to maximize the amount of transfer of moisture from the particulates in the fluidized bed to the injected air. The filter jacket on top creates a path for the entrapped solvents liquid to evaporate off the product and leave the drying vessel.

Air drying offers several unique benefits over other technologies on the market. Some products are pressure sensitive and can become more reactive at lower pressure thus eliminating vacuum driers as an option. Besides pressure sensitive materials, air drying also can help with thermally sensitive products because the injected air can be controlled to achieve evaporation at lower temperatures. This style of drying is also most seen in granulation and agglomeration type operations where the plow mixers are used to help build particle sizes of materials and they need a gentler dry cycle not to damage the granules.

To help achieve particle size build up in granulation type applications, plow mills can be equipped with devices called choppers added to them. These are essentially high-speed blades placed on the side walls of the unit between the plows. Depending on the time used in the process these blades can be used to either increase or decrease the particle size. For operations where particle size needs to increase choppers are used at the initial stage of the operation. During the initial stage, choppers are turned on to permit the liquid binding agent to help the particles agglomerate once liquids are injected into the system. Once the particles are built up it is vital to reduce the shear forces in the system. For this reason, companies must often use a gentler form of drying which is why air drying is used for these operations.

During the drying operation, the unwanted solvents can be removed as they exit the dryer as a vapor. The vapor rate can be quite large because of the good heat transfer and the vapor volume will expand as much as 15 times the liquid volume. Therefore, it is useful to have a set of filters to separate the generated vapor from any potential entrained solid product. To prevent the filters from getting wet with condensed vapor, the filter housing should be jacketed to provide heat input to maintain the vapor form. The filter can be cleaned by applied a pulsing mechanism that is directed down the inside of the filter dislodging any collected dry product. This type of filter unit is referred to as a Pulse-back Filter housing.

After reaching the final desired volatile content in the product, the material can be cooled for collection and final packaging without exposing the operator to dangerous conditions. Cooling of the product can also reduce the risk of fire or explosion by exposing the product to the atmosphere. The vacuum dryer can also be purged with an inert gas to further protect the product as well as the operator if the liquid being removed is a flammable solvent.

Processall's Plow Mixing technology gives chemical manufacturers a leg up on the competition. Listed below are some of the benefits of moving toward plow mixing technologies for chemical manufacturers.

- High heat transfer rate with coefficients upwards of 50 BTU/(hr·ft<sup>2</sup>·°F) which increases the speeds of drying
- Lower vaporization temperatures protect thermally sensitive material
- Can be customized with a wide variety of safety features to improve employee safety when handling dangerous materials
- Ability to serve as both a reactor and dryer of materials thus reducing the need for multi-unit operations.
- VFD motors enabling wide levels of control for the mixer speed therefore better control of the particle size of the dried material
- Can be customized to include pulse back filters to reduce product loss during drying
- Thermal jackets to allow for optimal temperature controls.

Processall maintains a fully equipped testing facility in Cincinnati, Ohio designed to provide customers with the data they need to develop their process, evaluate equipment, scale-up, and identify the necessary equipment to maintain desired production volumes. We extend an open invitation to all potential customers to bring their product to our test center and get a "hands on" experience with our technology and capabilities.

We also maintain a rental fleet that customers can utilize to do further testing at their facility or employ to minimize their startup costs for a new process.

**Please feel free to contact us with all your material processing questions and our experienced industry professionals will help you find the right mixing solutions for your particular application.**



4600 N. Mason-Montgomery Road | Mason, OH 45040 | 513-923-5904 | sales@Processall.com

Contact us today  
[www.Processall.com](http://www.Processall.com)

