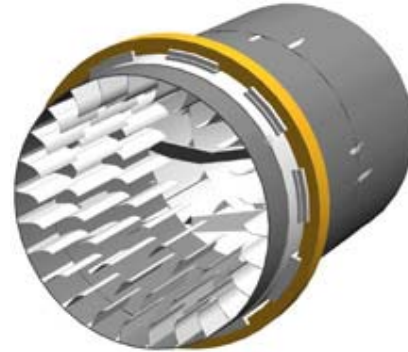


Rotary Dryers, Part 1

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A Review of Major Dryer Types

Concluding my series on general drying systems, in this column I will cover rotary dryers. Rotary dryers potentially represent the oldest continuous and undoubtedly the most common high volume dryer used in industry, and it has evolved more adaptations of the technology than any other dryer classification. Rotary dryer technology includes direct rotary cascade dryers, indirect (steam) tube rotary dryers, multipass rotary dryers, rotary tube furnace dryers, and rotary louver dryers. Drum dryers are sometimes referred to as "rotary" drum dryers and paddle dryers are sometimes referred to as "rotary" paddle dryers, but the technology behind these dryers is distinctly different and will not be included in this family.



Spiral flights quickly move the material out of the feed section. Lifting flights elevate the material to produce a curtain. The drum is supported by a riding ring. Photo courtesy of Drytech Engineering.

In simple terms, a rotary dryer introduces wet feed into one end of a tube and a hot gas into the same or opposite end. The tube rotates and the hot gases and feed are intimately mixed while being transported down the tube, producing a dry product and a wet exhaust. Let's slow down -- it's not that easy!

As I have mentioned many times in my columns, the presentation of the feed to the carrier in the most intimate manner possible is a fundamental art aspect of designing drying systems. The better this is achieved, the more efficient and effective the operation. It is arguably more difficult to achieve this with rotary cascade dryers than most any other drying technology.

Because the heat transfer and presentation aspects of the different variations of these dryers are not the same for each configuration, these will be discussed individually. All rotary dryers have the feed materials passing through a rotating cylinder termed a drum. The drum is mounted to large steel rings, termed riding rings, or tires that are supported on fixed trunnion roller assemblies. The rotation is achieved by either a direct drive or chain drive, which require a girth gear or sprocket gear, respectively, on the drum. The drum expands at operating temperature, so it is important that only one side, usually the feed end, be constrained with thrust rollers in the longitudinal direction.

The drum normally is inclined down from feed to discharge at an angle of 1 to 4 degrees. The initial section of the drum has helical screw or spiral flights to rapidly move the material out of the feed section. Material moves from one end of the dryer to the other by the motion of the material falling "forward" or rolling "downhill" due to the angle of inclination of the drum as well as other dynamics associated with the angle of inclination and the rotation of the drum. Frequently, there also is a discharge spiral section to prevent blocking of the dryer discharge. Rotary dryers can process extremely high volumes of product: The drums can have diameters ranging from less than half a yard for laboratory units to in excess of 13' (4 m) for large-scale applications.

Direct Rotary Cascade Dryers. The most common type of rotary dryer, direct rotary cascade dryers have internal lifters or flights to elevate the feed and drop it in a curtain from the top to the bottom, cascading along the length of the dryer -- hence the name rotary cascade dryers. These flights need to be carefully designed to prevent cross-sectional asymmetry of the curtain. The flights are arranged in repeating patterns, and the dryer should have several rows of distinctively designed flights that are indexed and offset to form numerous simultaneous curtains along the drum length.

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