



Technical Article

Feeding of Bulk Solids: A Review

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The benefits of mass flow have long been recognized: elimination of ratholing, controlled flow of fine powders without flooding, minimization of segregation, defined and predictable residence time for processing applications, no stagnant regions where particles can degrade, etc. Design techniques developed by Jenike [1] have been proven over the last 40 years in thousands of applications around the world in virtually every industry.

Jenike's work primarily focused on how to design the hopper section of a storage or processing vessel. By selecting proper hopper angles, geometry and materials of construction, conditions conducive to developing mass flow are present [2]. Unfortunately, mass flow doesn't always result even when these parameters are all met. The problem is often related to the feeder and the manner in which it withdraws material from the hopper outlet.

Consider for example a hopper with an elongated outlet which employs a screw feeder to control discharge. If a constant pitch, constant diameter helical screw is used, flow will be confined to the back end of the screw. As shown in Fig. 1, this preferential flow pattern will propagate up into the hopper above, enforcing a funnel flow pattern even if the hopper design meets the requirements for mass flow.

In this paper, common feeders used for bulk solids applications will be reviewed, and some of the common mistakes as well as proper design techniques will be pointed out.