KNOW FLOE'S KORNER

Top Ten Tips To Avoid Screw Feeder Discharge Problems

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"Know Floe's Korner" is a contribution from the members of Group 3c (Solids Handling & Processing). The objective of this section is to share their industrial learning experiences through a variety of articles & case studies. The next article focuses on tips to counter segregation in bulk solids handling. Please send your comments to Shrikant Dhodapkar at sdhodapkar@dow.com

1. It is important to design the feeder and hopper as an integral unit. The feeder is not a "discharger", therefore, reliable flow out of the hopper is essential for proper feeder operation. If the material has difficult flow properties, use a Mass Flow Vee-shaped hopper section, with vertical or slightly diverging end faces and a slot length of at least three times its width. Material discharge must take place over the entire outlet for a Mass Flow hopper to work. This can be accomplished by combinations of variable diameter, variable shaft diameter and variable pitch screws.

2. Check that the flight tip clearance is large enough to avoid particle trapping for wedging or granule degradation. But also ensure that the residue in this clearance does not continue up a side wall slope, to prevent slip of the material or provide a 'toe' to support an arch.. It is good practice to adopt a 'U' shape of feeder casing, so that the vertical sides allow material to pass from the hopper outlet onto the screw without interference from static residue in the flight tip clearance.

3. A screw will not restrain a fluidized powder from flushing out of a hopper. If the product is prone to flushing, install a valve on the discharge port, interlocked to be open only when the screw is running and with an emergency override 'close' switch. For non-aerated materials, make sure that the distance from the outlet end of the hopper wall to the start of the outlet is adequate to retain the hopper contents when the screw stops. A length of two screw diameters is usually sufficient, unless the bulk material is in an aerated condition.

4. Always confirm that the screw outlet can not be blocked, obstructed or admit a reverse gas flow. Un-vented rotary valves leading into pneumatic conveyors often pass back air by leakage and via returning vane pockets. With no means of escape this air can resist flow from the hopper. Allow a gas bypass route for the material to flow freely from the feeder. Although screws can develop powerful axial forces, bulk solids will not transfer pressure round corners or any distance along channels or ducts. When feeding damp or 'sticky' material it is good practice to expand the casing at the outlet and slightly project the underside beyond the down-wall of the discharge chute, so that the material falls free of chute wall contact. Ribbon screws can also be used in such cases. Fit a torque limiter or a level detector to isolate the drive if there is any prospect of back up from downstream equipment.

5. It is not uncommon for the starting load to be five times the operating load. During initial filling conditions, peaked stress field is generated in the bin where large loads are transmitted to the feeder. With flow initiation, a radial stress field is developed in the hopper where most of the load is supported by the hopper walls. This field is retained even if the flow is temporarily stopped. Feeder loads during startup can be significantly reduced by creating radial stress field, for example, by withdrawing small amount of material during filling. Leaving the hopper partially full before refilling will also achieve the same purpose.

6. Both starting and running torque are influenced by the area of screw exposed to flow pressures. Feeder inlet lengths exceeding three times the screw widths do little to improve the flow prospects but may be used to enhance storage capacity or steepen the end walls of a hopper. To reduce the pressures acting on the screw when long inlets are used inverted Vee inserts along or across the hopper outlet slot can be fitted.

7. Clearly distinguish between average and instantaneous feed rate. Between what limits must each fall? Cyclic variations can arise from angular position of screw flight rotation. Short-term fluctuations occur due to end point cohesive instabilities with poor flow products. Even with very free flowing materials, small erratic flushes take place on the slope of discharge repose because of small 'avalanches' at low feed rates.

8. Never fit an intermediate bearing to a feeder screw. Any restriction on material flow can lead to high power consumption or blockages, therefore ensure that there are no bolt heads, welding splatter, shorter flight pitches or poor flight joints to impede progress within the confines of the casing.

9. For fibrous and elastic materials, the degree of capacity expansion along the screw axis is important to relieve working pressures. For stringy products, use twin start screws to prevent material wrapping around the shaft.

10. The screw flight surfaces should be smooth for the product to slip on the contact face at all times. Sticky or adhesive products and moist or wet materials can build up on the contact face which can affect the screw capacity. Various release coatings can be used to alleviate this problem.

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