Improvement of Discharge System into a Conveying Pipe

Project Scope

Bulk material: Aluminium hydrate, known to be a very abrasive material

Equipment: Existing metering valve used to discharge alumina into a pneumatic conveying system at a rate of 1 to 20 t/h. The valve operates via a conical plug moving up or down, thus changing the annular opening size and controlling the material discharge.

Problem: Feeding into the conveying system is unreliable, leading to process interruptions. This problem has been existing for 20 years.

Goals: - Identify the reasons for unreliable material discharge

- Investigate solutions

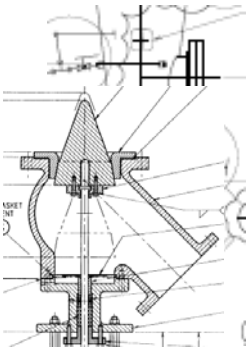

Figure 1 : Sketch of the existing metering valve

Strategy used by TUNRA Bulk Solids

Analysis of the discharge issue

Step 1: Getting un-biaised information on the existing operational issues. The goal was to identified what is really happening in contrast to what the operators /engineers thought was happening.

Step 2: Investigate the flow properties of the specific material including material arching dimension, compressibility, cohesiveness and flowability.

Step 3: Relate the results of flow properties with existing design and operation procedures to identify the issue.

Investigate solutions

The client asked for these 4 options to be investigated. Manufacturers of screw conveyors and rotary valve all claimed that their system is the best for this application.

1. Improvement to the existing equipment
2. Replacement by a screw conveyor
3. Replacement by a Fuller-Kinyon™ pump
4. Implementation of a Lisbon rotary valve

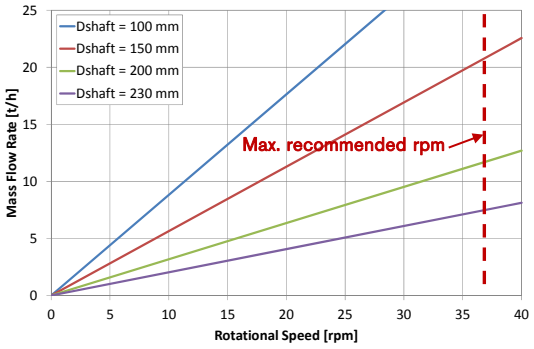

Figure 2 : Calculation of the operative curve for a rotary valve with 350 mm diameter

Project Outcomes

The material was arching in the metering valve!

Although the client always assumed that the discharge issue does not result from the metering valve operation but from bridging occurring in the hopper feeding it (and air jets had been put in place in this hopper to break the bridges), it was found that the annular opening was too small for the aluminium hydrate, resulting in material arching. The opening was 70 mm when fully opened while flow property testing showed that the material arching dimension is 120 mm.

Solution

Replacement of the discharge system was the only solution. Using a screw conveyor was not recommended due to the great size of the screw required to avoid material arching and the resulting very low screw speed to achieve the desired low range of throughput. A Fuller-Kinyon™ Pump was found to not have any benefit for this application while having high risk of blockage, high maintenance issues and high power consumption. Using a rotary valve was found to be the most suitable solution to replace the current system, although aspect of wear must be considered.

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