SUPPLIERS' TIPS

How can I select a storage vessel to handle my hygroscopic material?

Hygroscopic materials absorb moisture from their surrounding environment and are challenging to store because of increased potential for material bridging, caking, and expanding. In simple terms, materials can become heavy and sticky.

The climate outside of a storage vessel contributes to the stored material's absorption rate. Ideally, cool, dry, controlled environments are the best locations, but these environments aren't the typical sites where storage vessels are needed. Factors such as humidity rates, rain, snow, and fog should be reviewed when planning a vessel.

Based on these facts, the vessel's design is crucial. Vessels being used for storage need designs that will support material with significant weight and that have difficult flow properties. This will typically mean designing a heavy-duty storage vessel with a discharge (or discharges) that can support mass flow, such as a silo with upgraded walls and a steeply pitched bottom cone.

The vessel's structural supports will also need to be considered for the design. Dense materials will add weight to the vessel walls, which means that the vessel's structural supports should be strong enough to support the material's weight at its heaviest.

All additions to the vessel must ensure that moisture won't enter the vessel. To seal the vessel and limit exposure of environmental conditions, choose airtight options and gaskets. Some beneficial options for storing hygroscopic materials may include access ports to assist with the material flow, inspection ports to monitor materials being stored, specially designed discharges to allow for better flowrates, vibrators, and hammer pads.

Designers and fabricators must ensure that the vessel's internal surface has limited or no material buildup points. Smooth walls will limit hygroscopic material buildup on surfaces that could cause vessel damage or limit the material flowrate.

Adequate venting is also required for vessels storing hygroscopic material. Venting will allow the material to move freely through the vessel and limit the chance of a vacuum collapse, which is when walls are pulled in during vessel discharge.

Although we generally can't control environmental factors around the storage vessel, we can limit their impact with proper design that ensures proper hygroscopic material storage and discharge.

Jeff Kenzie, branch manager, Meridian Manufacturing, 800-830-2467

Hygroscopic materials need differing levels of protection when in storage. The protection choice also depends on other factors like storage duration, upstream and downstream processes, and the local environment. A silo design that promotes mass flow will decrease the material's residence time to absorb available moisture and decrease the need for dehumidification.

The typical solution, however, is to use dehumidified (dry) air as a blanket on the top of the material, as well as dehumidified supply air to any conveying systems joining the silo and any flow aid devices that force air into the lower portions of the material column. One important thing to consider is how to efficiently use the dehumidified air because it does require more energy to use than untreated air.

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Look for a storage vessel with gas-tight closures, nitrogen-inerting capability (ports), or as an alternative to inerting, have a desiccant holder. The vessel must be airtight and be able to hold a 2-psi purge, and should be purged prior to filling with material. The upstream and downstream material processes will determine the appropriate way to handle and store the material in preparation for eventual discharge from the storage vessel.

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Equipment suppliers are a valuable source of information about equipment and processes. In light of this, each month we ask suppliers a question of concern to our readers. Answers reflect the suppliers' general expertise and don't promote the suppliers' equipment. If you have a question you'd like suppliers to answer, send it to Kayla Carrigan, Associate Editor, Powder and Bulk Engineering, 1155 Northland Drive, St. Paul, MN 55120; fax 651-287-5650 (kcarrigan@cscpub.com).