SUPPLIERS' TIPS

# How can I choose a mill that will safely handle my combustible material?

Start by defining the hazard associated with your material. The National Fire Protection Association (NFPA) classifies material into hazardous groupings. These groupings define the energy amount required to start an explosion in atmosphere as well as the lower explosive limit (LEL), which is the material amount necessary to support an explosion in a confined space. Most mills are constructed of materials that can create a spark either by internal parts failing or by foreign material entering the mill. If the spark's energy is great enough and the material's concentration is above the LEL, an explosion can occur.

For some explosion groups, an explosion-proof electric motor's housing is strong enough to prevent the energy of an internal explosion from reaching outside the motor if an explosion occurs. In a continuous process mill, the inlet and outlets are open, and if an explosion occurs there's no method to confine it. However, explosive venting could be used to vent the explosion into a harmless area. This can be tricky because the mill's structure and ductwork must be capable of withstanding the pressure buildup during venting. The process could also be used in an explosion-proof barricade to protect operators. Another option is to use inert gas to flood the mill so there's nothing for the material to react with.

Suppliers can provide mills with an explosion-proof motor, drive belts, and bearings, but this doesn't necessarily make a mill explosion-proof. You must perform a thorough hazard analysis on the complete process and take any necessary steps to ensure that either no explosion can occur or, if it does, it either must be safely vented or the whole unit must be operating within an explosion-proof barricade.

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A mill is only part of a complete system, and the entire system must be protected when handling combustible materials. First, you need to understand the nature of the hazardous material or its potential to explode or burn and what the force of a potential explosion would be. This can be found by investigating the ST range or Kst value of the material, including both the feed material and the final processed particulates. ST values are ranges of pressure rise rates. Kst values are a specific number that refers to the pressure rise rates.

If the material presents a dust explosion, there are two ways to protect the mill. First, design the mill to be explosion- and pressure-shock-resistant up to 10 bar overpressure (150 psig). This won't make the mill operable immediately following an event because it will likely be damaged or deformed, but the surrounding area and operators will be protected. Second, use an explosion-suppression system on the mill. Process sensors detect a rapid rise in pressure or temperature and release a quenching agent to stop a fire or explosion as it starts. The quenching material is usually released in milliseconds.

The complete milling system can be protected in similar ways. It can be designed for complete explosion containment, but this can be very expensive if a large dust collector is involved and if the material contact surfaces are constructed of stainless steel. Usually a combination of protective measures is employed, such as using an explosion- or suppression-vented dust collector. If the duct runs are long, pressure can build high enough to exceed even an explosion-resistant mill. In those instances, a fast-acting valve can be installed in the pipeline between two system components. The valve is activated by pressure sensors in the system and activates within milliseconds.

Make sure your material, system components, and plant layout are evaluated by qualified engineers and safety experts. Only then can you choose the best option for processing your potentially hazardous material.

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Choosing a mill to safely handle your combustible material requires an evaluation of both the material and the mill design. Will the material burn or explode? What are the hazards to the operator? These and other questions must be asked to determine the safest milling equipment for your material. In terms of mill design, options include nonsparking materials of construction, underwater operation options, or the use of inert gas or a liquid blanket to operate.

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When choosing any mill, the key is to get the right grind for your material. To eliminate combustibility, the mill should be completely sealed and purged with an inert gas to eliminate oxygen. Grounding straps and low-impact grinding can reduce the energy sources and prevent ignition. Minimizing dust generation is also important since the dust is often more combustible than the raw material.

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