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10 Golden Rules for Dust Control

Rule 3: Work in closed systems wherever possible

The most effective technical measure for dust control is to work in closed systems (encapsulation, enclosure). The dust-free feeding, processing, emptying and storing of powdery materials, however, presents the highest demands on planners and design engineers. Above all, cost-effective solutions must be found for low-maintenance continuous operation.

The advantages of a closed system for the protection of health, but also for the product quality, are obvious. In closed batch and continuous operation with automatic raw material feed, all substance and process values are recorded consistently using modern IT-supported weighing and control technology. The control of these parameters is a crucial factor for quality and competitiveness.

Feeding of material

At the starting points and interfaces of production processes where material is introduced ("material feeding"), the danger of releasing dust is particularly great. **Engobes, glazes and similar raw materials are generally supplied in big bags or paper bags. Pouring out by means of simple feed hoppers no longer conforms to the state of the art!** For emptying big bags there are tried and tested easy-to-operate attachment systems (e.g. clamping or inflating collars), which facilitate a dust-tight connection. Via such a dust removal attachment not only can the aspiration air be extracted but also the big bag can be evacuated. Finally it can be removed and disposed of without formation of dust.

For dust-free feeding of dry bulk materials from paper bags, bag emptying stations are state of the art. The best variation is a closed system which automatically rips open and empties the bag, compresses the paper wrapping and subsequently dispensing with it in a dust-free manner. Even simpler designs using a bag-supporting table provided with dust extraction and pouring opening considerably reduce the dust exposure and, moreover, stress on the back. An inserted coarse grid prevents parts of the bag falling into the mass when manually slitting the paper bags.

Transporting and conveying material

In the pneumatic conveyance method the tendency to dust formation of powdery solids and granulates is utilised as a conveying principle: By applying pressurised air a free-flowing of solids and air is created (fig. 1)

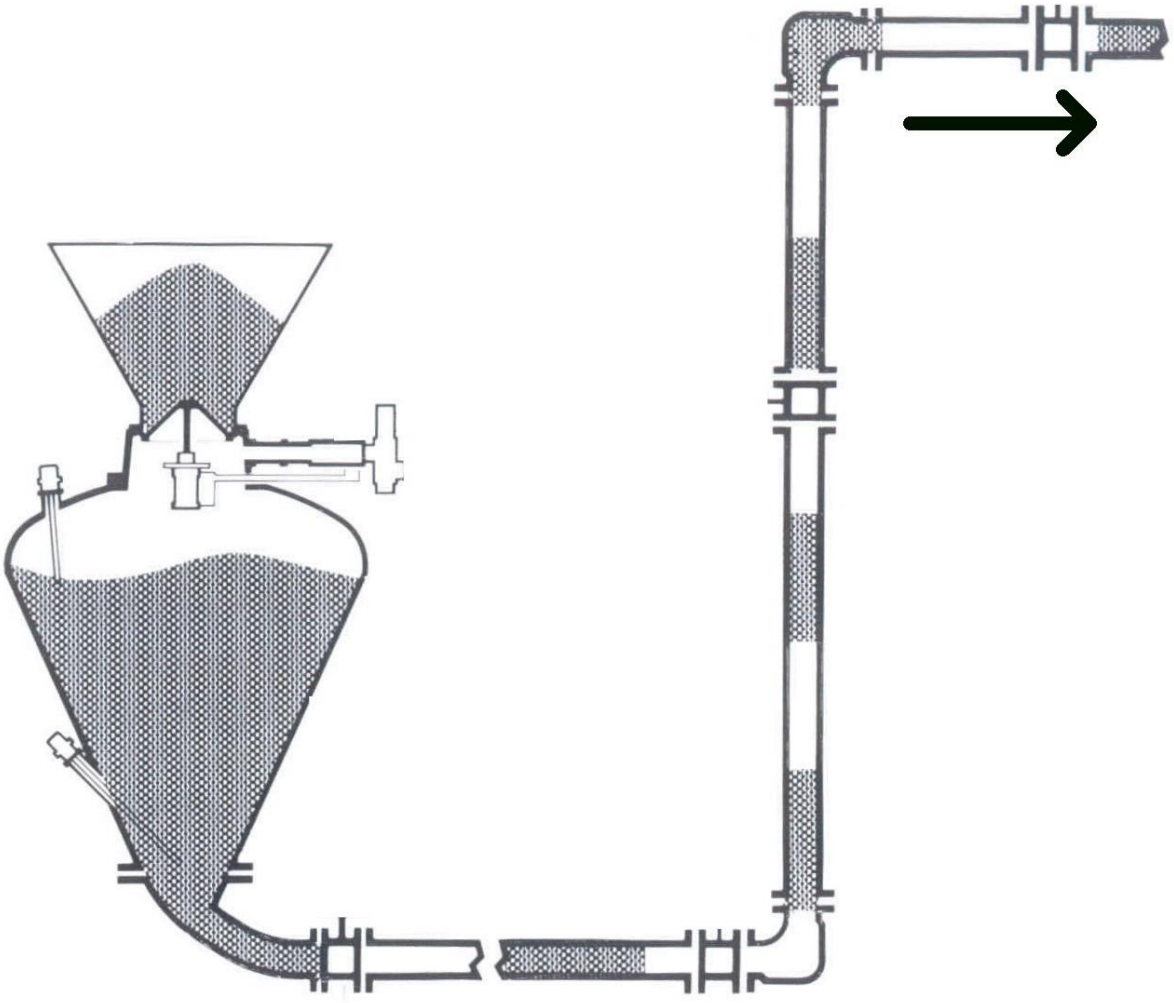

Fig. 1: Working principle for pneumatic conveyance

Pneumatic conveyors facilitate flexible and sophisticated routing to overcome greater distances (> 30 m) in a closed system. A simple ductwork system with as few internal fittings as possible guarantees long maintenance intervals. The use of wear-resistant bends or wear-reducing methods for changing the direction of the material flow ensures a long service life of the system technology. Attention should be paid that the clearance filter for the outflowing feed air is regularly maintained.

Pneumatic conveyance technology has also been developed for lumpy dry bulk materials, e.g. for coal, coke, slag, shards, lumped lime and wastes. The edge length of the lumps can thereby be up to 40 mm.

Closed vibratory feeders and screw conveyors are an alternative to pneumatic conveyance. Using these conveyor systems the material can be transported over limited distances but at the same time can be dosed very accurately. The screw conveyor is suitable for coarse-grained, fine-grained powder or adhesive dry bulk materials that tend to split. For the gentle and low-wear dosing of goods that are susceptible to break and splitting, vibrating dosing feeders should be used. As a result of the vibrating motion, however, grading effects and thus separation can occur.

Bucket elevator systems are regarded as being particularly advantageous with regards to dust since they facilitate both vertical and horizontal material transport without transfer points. Since in a bucket elevator system material residues can fall out of the returning buckets, the system is to be additionally equipped with collection devices underneath. The material that falls out can be collected in a funnel-shaped container and be carried away by means of an extraction system. Negative pressure in the entire conveyor belt area prevents the release of dust as a result of leakages. Transfer points for material at the

intersections of the individual system components are to be particularly observed. Encapsulation in this area is mandatory for effective dust control (fig. 2).

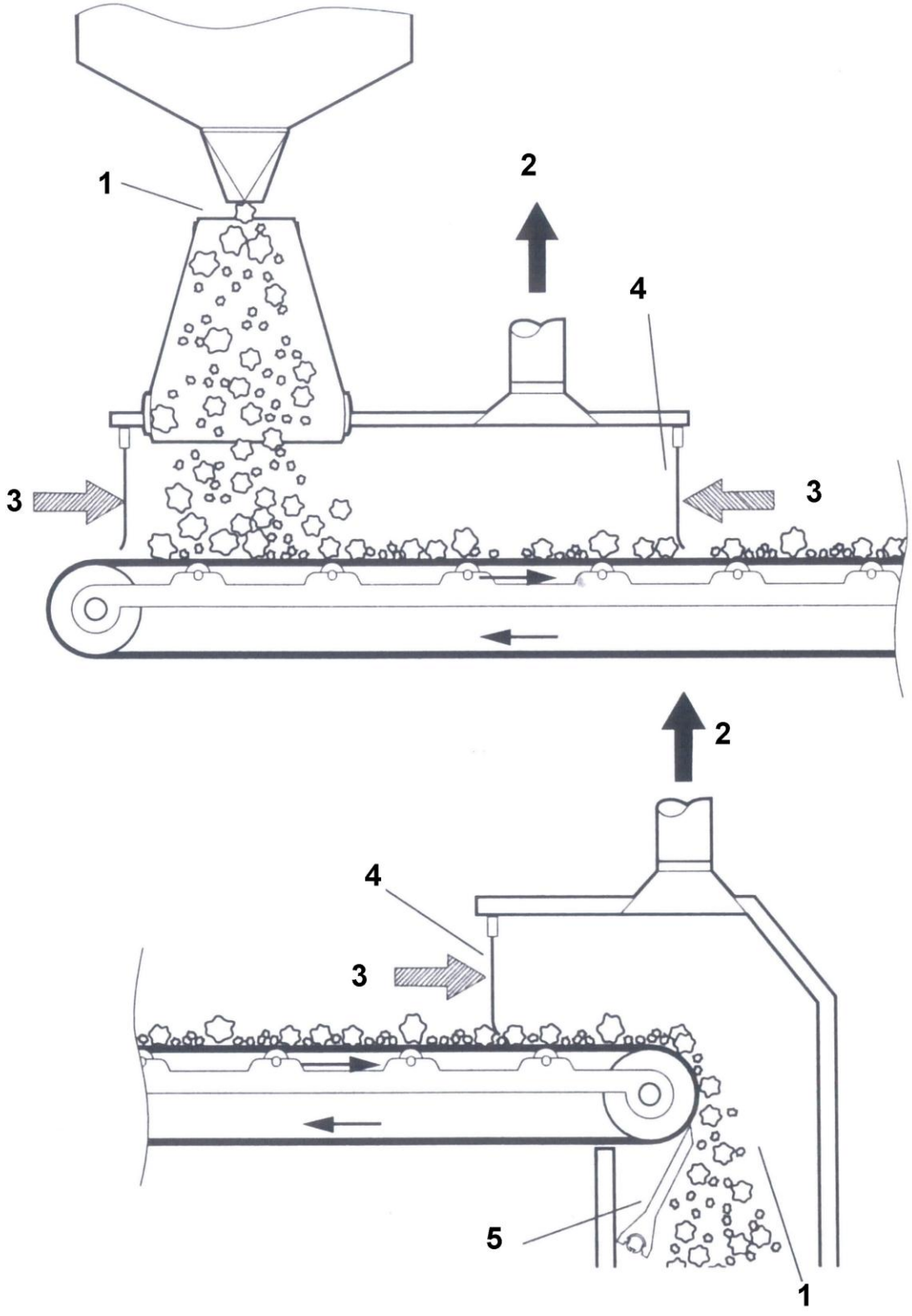

Fig. 2: Encapsulated belt transfer point (1 minimising the fall height, 2 extraction system, 3 supply air, 4 dead plate, 5 belt wiper)

By means of using an enclosure, continuous conveyors can be operated in a virtually dust-free manner. Belt clearance systems (e.g. rotating brushes at the direction change point) are to be encapsulated in a dust-tight manner as well or have to be integrated into an existing enclosure.

Machining and processing of material

The principle of encapsulation or enclosure of dust sources not only applies to machines and systems. **Also by means of spatial separation of entire plant sections (e.g. material preparation), the spreading of accumulated dust as a result of draughts or plant-internal traffic is prevented.** Conveyor belt systems are particularly well suited for being built up in ventilated areas separated from the working space, e.g. in accessible belt channels. By means of enclosing individual machines or machining steps such as, for example, milling and drilling centres with additional extraction system, the release of dust can be optimally eliminated (fig. 3).

Fig. 3: Enclosed machining centre

Closed installations must be accessible for maintenance and inspection purposes, an adequate number of suitable inspection openings therefore has to be provided. Simple sheet metal covers that are kept shut by means of a bracket, for example, are extremely unsuitable! In contrast, flanges with a corresponding screw connection facilitate repeated dust-tight sealing.