

Ceramic powder drying system



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POWDER SILOS



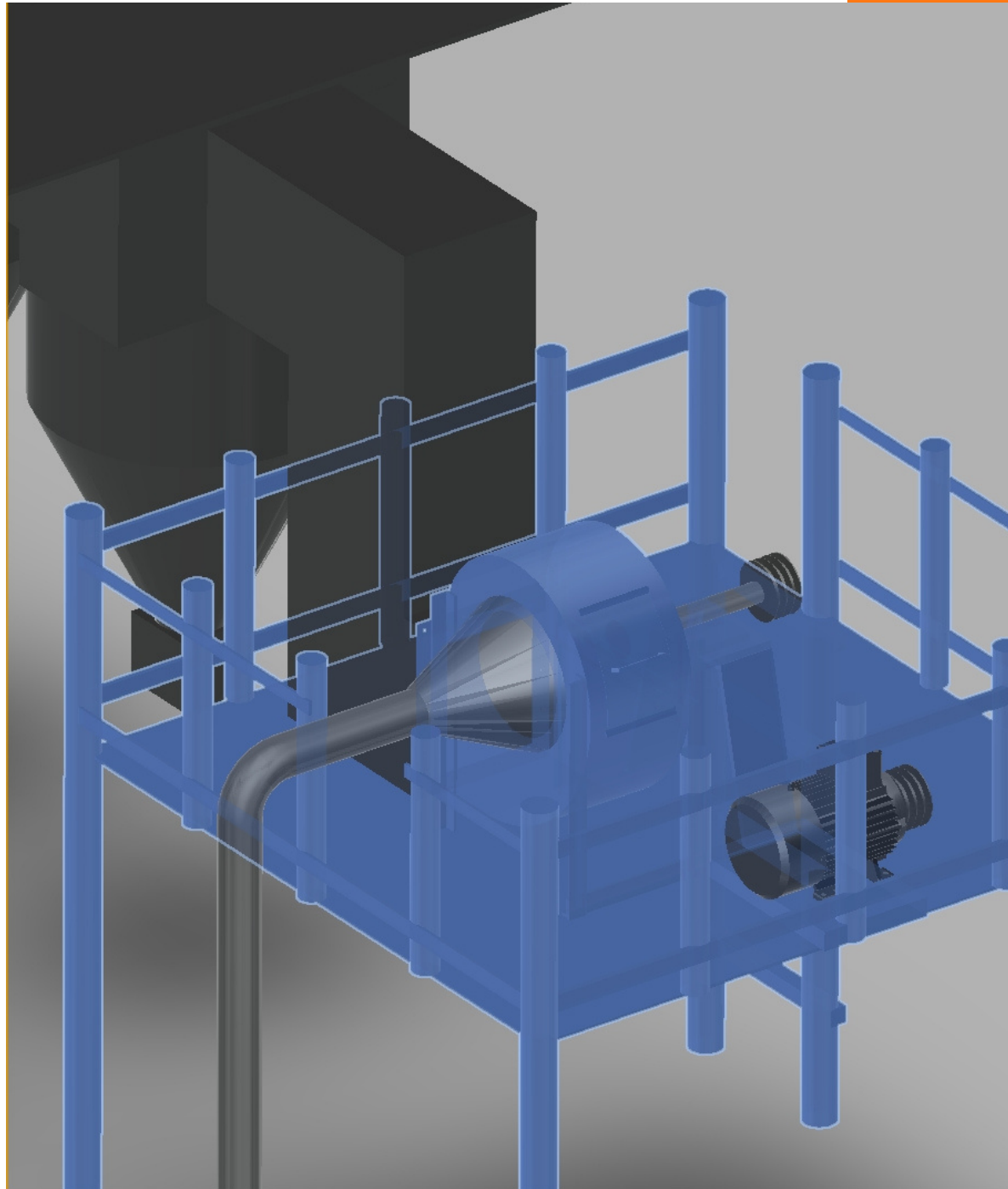
Storage of Powders and Bulk Solids in Silos

silos and the pressures and stresses, respectively, acting in the silos. While the pressure (for fluids we will use the word „pressure“) would increase linearly downwards if the silo would have been filled with a fluid (a), the course of the vertical stress (for bulk solids we will use the word "stress") in a silo filled with a bulk solid is rather different (b,c): In the latter case in the vertical (cylindrical) section of the silo the vertical stress increases in a degressive way. If the height to diameter ratio of the silo is sufficiently large (usually: > 3) a constant vertical stress is attained. This means that the vertical stress will not increase further even if the filling height is much larger. The reason for this course are the shear stresses acting between the bulk solid and the silo walls even if the bulk solid is at rest. Due to the shear stresses, the silo walls carry a part of the weight of the bulk solid. A method for the calculation of the stress course in the vertical section was derived by Janssen already in 1895 [1]. This method is the basis for most present standards for calculation of the load on silo walls for structural silo design.

The stresses acting in a hopper are different from those in the vertical section. Just after filling an empty silo, the so called filling stress state (also: active stress state, figure 1b) prevails, where the vertical stress in the hopper decreases less in the upper part of the hopper and then more near the imaginary hopper apex. As soon as some bulk solid is discharged for the first time after filling, the stresses in the hopper change and the so-called emptying stress state (also : passive stress state) prevails, figure 1c. When flowing downwards in the hopper, the bulk solid is compressed in the horizontal direction so that the walls of the hopper carry a larger part of the weight of the bulk solid and, hence, the vertical stress in the lower part of the hopper is clearly smaller than after filling. In the emptying stress state the vertical stresses in the lower part of the hopper are nearly proportional to the distance to the imaginary hopper tip or, in other words, the stresses are proportional to the local hopper diameter. This linear course of stress is called the radial stress field [7]. In principle, in the vertical section of the silo the stresses remain unchanged at discharge.

Chimney centrifugal fan

Chimney centrifugal fan for industrial heating system management using heat of chimney or fireplace. It can be also used as a base for backup heating source.



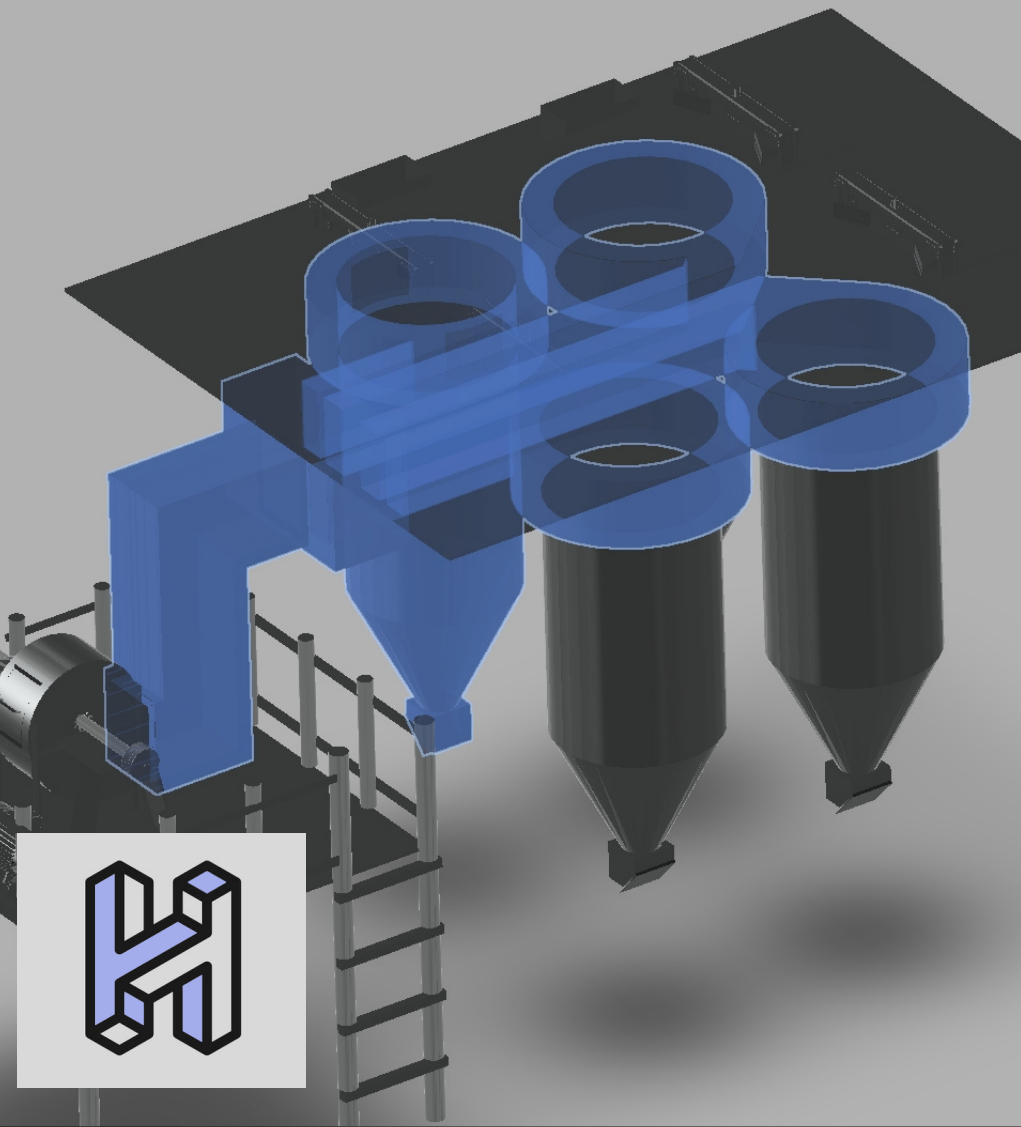
MARKETING PROPOSAL

Cyclonic separation

Cyclonic separation is a method of removing particulates from an air, gas or liquid stream, without the use of filters, through vortex separation. When removing particulate matter from liquid, a hydrocyclone is used; while from gas, a gas cyclone is used. Rotational effects and gravity are used to separate mixtures of solids and fluids. The method can also be used to separate fine droplets of liquid from a gaseous stream.

A high speed rotating (air)flow is established within a cylindrical or conical container called a cyclone. Air flows in a helical pattern, beginning at the top (wide end) of the cyclone and ending at the bottom (narrow end) before exiting the cyclone in a straight stream through the center of the cyclone and out the top. Larger (denser) particles in the rotating stream have too much inertia to follow the tight curve of the stream, and thus strike the outside wall, then fall to the bottom of the cyclone where they can be removed. In a conical system, as the rotating flow moves towards the narrow end of the cyclone, the rotational radius of the stream is reduced, thus separating smaller and smaller particles. The cyclone geometry, together with volumetric flow rate, defines the cut point of the cyclone. This is the size of particle that will be removed from the stream with a 50% efficiency. Particles larger than the cut point will be removed with a greater efficiency, and smaller particles with a lower efficiency as they separate with more difficulty or can be subject to re-entrainment when the air vortex reverses direction to move in direction of the outlet.

An alternative cyclone design uses a secondary air flow within the cyclone to keep the collected particles from striking the walls, to protect them from abrasion. The primary air flow containing the particulates enters from the bottom of the cyclone and is forced into spiral rotation by stationary spinner vanes. The secondary air flow enters from the top of the cyclone and moves downward toward the bottom, intercepting the particulate from the primary air. The secondary air flow also allows the collector to optionally be mounted horizontally, because it pushes the particulate toward the collection area, and does not rely solely on gravity to perform this function.



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