DUST SUPPRESSION HOPPER

TARDIS MODEL OVERVIEW
SECTION 1 – Overview

The Dust Suppression Hopper (DSH) is designed as a solution for preventing the formation of dust clouds during the transfer of granular solids. Originally developed to tackle dust emissions at fertilizer plants, applications have since expanded to include many different granular, free flowing solids such as Foodstuffs, Grains, and Mineral/Quarry Products.

The design of the DSH marks a radical departure from conventional telescopic spouts and produces a denser, less aerated flowing material phase. A conical outer hopper is suspended from the top frame of the unit by a number of springs, and a safety chain. Within the hopper is a central plug which remains stationary at all times. As material flows into the DSH its weight causes extension of the springs and the outer hopper lowers relative to the stationary central plug. This gradually increases the area of the annulus between the central plug and cone wall, allowing a certain level of material to be maintained in the hopper as equilibrium is reached with the incoming feed. In practice the outer cone gently oscillates up and down during discharge, as the balance of forces between the non-linear springs and weight of material fluctuates. This action maintains the characteristic solid-looking stream of product.

The DSH is installed directly beneath a feed point and suspended at some height above a target, such as a truck filling bay. Aside from the constrained up and down movement of the hopper, this height is maintained throughout discharge. Most of the complexities associated with the telescopic spout design are therefore eliminated. The DSH has no internal moving parts and requires no utilities for operation.

The way in which the DSH operates leads to material discharge in the form of a densified, almost solid stream containing very little air. As material flows into the hopper, natural agitation and settling lead to limited air release. Then, because the material is pushed out of the annulus against the opposing pressure of the springs it undergoes a further ‘squeezing’ action. The result is a ‘condensed’ stream of material that is extremely tolerant of fall height. During transfer any dust present is entrained and drawn down into the material column. There is minimal dust emission when the product hits the ground as the densified column effectively buries into the building pile of material on the ground and limits the release of dust on impact. The squeezing out of air also largely eliminates product segregation.

The simplicity of the DSH translates into low maintenance costs and the almost complete prevention of dust release for a many industrially significant bulk materials.
SECTION 2 – The Standard Model DSH

The standard model DSH consists of a rectangular steel frame from which the central plug and hopper cone are suspended. The central plug is fixed directly to the frame by means of the angled plug support arms. The hopper cone is suspended from the frame by a number of springs, which are attached to adjustable height bolts secured through the steel frame.

The DSH is mounted directly underneath the feed point. The open top frame of the standard model allows for great flexibility in mounting options. It is important to ensure that material flowing into the hopper is centered along the vertical axis of the cone and is not entering the hopper at a high velocity and/or with a high amount of entrained air.
Because the top opening of the hopper cone is open on the standard model, there is the potential for dust generation and escape as material is fed into the unit. The amount of dust generated at this point is dependent on a number of factors including the product, feed method, environment, etc.

Normally, having the feed spout mounted underneath the rim of the hopper is sufficient to minimize dust creation at the top end of the hopper. However, this method has the potential to back material up into the feed spout and so is not recommended for conveyor installations.

Installing a flexible dust cover is another solution to this problem. Sioux Steel can provide custom fabricated dust covers to interface between the feed spout and hopper cone. The covers are constructed out of a breathable, conductive polyester fabric. They are designed with hook-and-loop openings to accommodate the plug support arms and are meant to be banded around the hopper and feed spout. For applications involving particle sizes finer than 100 mesh and high velocities or air entrainment, the flexible cover may not be sufficient as particles may be forced out of small openings in the fabric. A typical example of such a cover is shown below.
SECTION 3 – The TARDIS Model DSH

The Tardis Model DSH replaces the open frame of the standard model with a completely enclosed steel cover. The spring and safety chain mounts are integrated directly into the cover itself. A customer specified flange mount is included for straightforward installation.

The Tardis cover overlaps with the vertical section of the hopper cone. This creates a dust free connection between the cover and hopper cone. Larger models include spigots and dust socks in the design to allow sufficient breathability inside the system. Custom ports and attachments to the cover are available at no cost as long as space permits.
The Tardis system is available on all hopper sizes from a DSH-MINI to a DSH-9. These hoppers may be constructed of Corten (3mm), Hardox (4mm), 304 Stainless (3mm), and 316 Stainless (3mm) steels. The cone section may additionally be constructed from rotational molded polyethylene.

The flange mount on the Tardis model allows for fast and simple installation to a vertical feed spout. However, it is recommended that brakes/baffles or a suitable velocity reduction mechanism be installed in vertical piping greater than 5-10 feet in order to minimize excess air entrapment in the bulk material.

We recommend a Tardis system for all applications with a significant fraction of the particle size distribution greater than 100 mesh. The flange mount and overlapping cover make the Tardis model our most efficient dust suppression system.
A DSH-MINI Tardis system installed on a vertical feed pipe for a silica sand unload application. This particular model had a custom port built into the cover to accommodate a dust extraction system.
The same Tardis system above unloading silica sand into an open top truck. This particular sand had >20% passing 100 mesh, >8% passing 140 mesh.