Explosion Isolation: A Natural Part of Dust Explosion Protection

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ABSTRACT

To limit the consequences of dust explosions in dust handling equipment, three main protection principles are applied: dust explosion venting, dust explosion suppression, and explosion containment. The implementation of these protection strategies is described in detail in standards, viz. NFPA 68 and NFPA 69. The design rules, however, assume that ignition occurs in the respective pieces of equipment themselves. If an explosion flame is allowed to propagate into the protected equipment from other equipment connected to the protected equipment via a duct, a combination of explosion generated turbulence and flame jet ignition will cause the explosion in the protected equipment to be far more violent, causing the explosion protection to fail. An example is shown in Figure 1. Both vessels have been protected by explosion venting according to the requirements of NFPA 68, reducing explosion pressures to less than 1 bar. Ignition is effected in V1, resulting in a violent explosion in V2 with pressures exceeding the design by a factor of more than 3.

The paper will present several examples of experimental results highlighting the need for explosion isolation as well as examples using the dust explosion CFD based prediction tool DESC.

The paper will discuss the several dust explosion isolation principles available and their design, including installation distances and limitations of application. Examples of tests performed with several isolation systems will be presented as well as prediction of their applicability using DESC.

\textit{Figure 1. Explosion pressure development in two connected vessels of 9.4 m\textsuperscript{3} (V1) and 4.4 m\textsuperscript{3} (V2) connected via a 30 m long 300 mm diameter duct.}