Silo dust extraction

One of the problems with dust extraction is too many people think it's easy and, like most things, it is when you know how! In the selection and sizing of a dust filter there are many aspects to be taken into account and one application as much as any other highlights any short fall, namely silo dust extraction.

On the face of it, fitting dust extraction to a silo should be simple: conveyed powder in, dust filter on top, cleaned air out. The reality is often quite different with aspects of the conveying system, the powder particle size, the dust filter size and can velocity all having an influence.

The air volume from a conveying system must be carefully checked. The volume entering the conveying pipe from the compressor is not the volume to be filtered, neither is the free air displacement (FAD) volume entering the compressor although based on it. At the pressures most conveying systems operate at there will be a temperature increase in the conveying air as it is compressed which, at the dust filter end of the system will increase the volume of air through expansion. So, the volume of air to be filtered should be the FAD volume entering the compressor increased by the ratio of the temperature rise through the compressor. The machine specification from the compressor supplier will provide all the information required, although the final volume will need to be calculated. In addition, any heat from the conveyed product should be noted and included in the calculation.

Air volume example.

In a 100mm diameter pipe at 25m/s, the volume will be approximately 700m³/h.

Assuming the line pressure is 0.3barG and the motor energy absorbed is 15kW,

The volume at the dust filter is calculated at 1080m³/h, some 50% above the volume entering the pipe!

The impact of this on the selection of the filter size is significant. Taking the next point, the powder particle size, too often there is a vague specification such as 90% >75micron. However it is the specification of the 10% below that size which is important and in particular the quantity, if any, below 10micron. At this size the dust will move very easily on air currents greatly increasing the risk of re-entrainment onto the filter media during the reverse jet cleaning process. The finer particles also means the filtration velocity, or air-to-surface ratio, must be lower to reduce the risk of penetration into the filter media.

Often the dust filter on a silo is mounted in a small upstand enclosure on the silo top. The rising air velocity from conveying air discharged in the silo up into the dust filter enclosure is a further design consideration. Known as the “can velocity” this too is
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dependant upon the air volume and a further aspect of potential re-entrainment, particularly with finer powders. A high can velocity may be difficult to address if the opening size in the top of the silo is too small or when a conveying system is increased in capacity and the corresponding air volume rises. As a guide the can velocity into the dust filter housing should not be greater than 1m/s.

In silo dust extraction, it is of the utmost importance to ensure, as a designer, the full and correct information are available. The actual air volume to be filtered is critical in the filter selection and silo top aperture size, where the quantity of sub 10micron is a further factor, as also in the dust filter sizing. When correct the silo dust extraction will prove successful in operation and robust in terms of maintenance. When incorrect however, problems may persist on a daily basis!