A Three-step Approach for The Use of Pulse-Jet Dust Collectors On Dryer Exhaust Applications

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All bulk material drying applications require a pollution control device as part of the system. The pollution control device could be a dust collector, a wet scrubber, or a cyclone. In this article we will focus on the pulse-jet dust collector which is most commonly applied, because of its efficiency, reliability, and proven performance.

With some types of dryers, the dust collector will receive all of the material as it is discharged from the dryer; this is referred to as the primary product collector. In other cases, the dust collector is used to capture fines and powder carry-over from the exhaust gas stream. In all drying applications, the presence of moisture in the collector inlet gas makes this one of the most challenging applications that we encounter for pulse-jet collectors.

Water vapor that enters the dust collector in the dust-laden heated inlet gas stream can condense to the liquid state if proper baghouse design and operation practices are not followed. In the liquid state, water can cause operating problems such as blinded filter bags, increased build-up of collected dust on the housing walls, bridging of dust at the hopper discharge, and/or corrosion of internal metals. Correct engineering design is paramount for an effective pulse-jet collector installation. Preventative maintenance and proper start-up and shut-down procedures can reduce or eliminate the possibility of moisture-related problems occurring.

The most important factor to consider when applying a pulse-jet collector to a dryer exhaust is that the gas temperature of the incoming gas stream should be at least 50 degrees F, and preferably up to 100 degrees F, above the dew point of the gas stream. The dew point of the gas stream can vary depending on the relative humidity and gas constituents of the dryer exhaust. The dryer manufacturer should be able to provide pertinent dew point information.

Depending on the differential between the dryer exhaust temperature and the ambient temperature of the air surrounding the dust collector, it may be advisable to include insulation on all surfaces of the dust collector and inlet ductwork, and even on the exhaust ductwork between the dust collector and the fan to minimize moisture condensation on cold surfaces. In some cases it may also be necessary to heat trace the collector and hopper walls under the insulation to increase the internal temperature if the operating temperature is too close to the dew point temperature.

Filter media selection is significant because some of the more common synthetic materials, such as polyester and aramid (Nomex®) that are commonly used in pulse-jet collectors, can undergo hydrolysis (a chemical reaction with the water molecules) in applications with moist heat. Hydrolysis weakens the bonds in the filter fibers and will typically make the fabric "brittle." Aramids (375°F maximum dry heat temperature) will typically hydrolyze at around 300° F and polyester (275° F maximum dry heat temperature) may undergo hydrolysis as low as 200° F, depending on the amount of moisture in the gas. There are a number of fabric options depending on the outlet temperature of the dryer. One often overlooked fabric selection on mid- to lower-temperature systems is acrylic. Acrylic has a maximum operating temperature of 280° F and will not hydrolyze. Customized medias are also available, encompassing any of a number of chemical and mechanical surface finishes, fiber treatments, and fabric and scrim weight and density variations, The experts at Sly can help you with optimal material selection for any specific application.

The chemistry of both the solid product and of the gas stream will impact the filter media selection as well as the materials of construction of the baghouse. The potential of either acid or alkaline attack is magnified if temperature excursions through the dew point occur. Internal coatings or alloy steel may be indicated in some applications. Special internal weld finishing may be needed to reduce or prevent any product build-up on the housing walls and/or hopper(s.)

Some dryer manufacturers are sensitive to the momentary rise in positive pressure that occurs during the pulse-cleaning cycle. One way to reduce this effect is to use a multi-position timer with as many contacts as possible so that a minimum number of rows pulse concurrently. The configuration of the baghouse that is selected can address this situation as well.

Discharge equipment should be properly sized and rated for the operating temperatures. Primary product collectors may need oversized valves to ensure steady discharge of the product from the dust collector hopper(s).

The most critical instrument for monitoring baghouse performance is a standard item—the differential pressure gauge. This may be an analog instrument like the Magnehelic® gauge, a fixture on pulse-jet collectors for many years, or the Photohelic® switch/gauge that, in addition to indicating differential pressure across the bags, has alarm settings and can control pulse cleaning on a demand basis. The modern technology that Sly offers to perform these same functions is the pressure module that plugs into the pulse timer board. It is important to remember that rising differential pressure may indicate moisture condensation causing build-up on the bags which can lead to blinding if not addressed quickly.

As a safeguard against thermal deviations, temperature probes may be located in various positions in the baghouse and ductwork to monitor baghouse temperatures and detect an upset condition, whether high or low. Too-high temperatures may damage the bags and too-low temperatures may cause moisture condensation. Sly's standard pulse timer contains terminals for alarms that can be used for temperature conditions and also for high and low differential pressure warning.

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The start-up procedure on a dust collector should be sequenced as follows:

1. Auxiliary heat sources, if applicable.
2. Dust discharge equipment (rotary airlocks, screw conveyors, and other conveying or discharge devices.)
3. Compressed air supply to the manifolds.
4. Power to the program timer to initiate the pulse cycle.

Before feeding product to the dryer, the main exhaust fan should be started, and heated dry air run through the system to preheat all cold metal surfaces to the operating temperature, and if natural gas-fired, to purge the system of any pockets of accumulated gas (products of combustion.)

On shut-down, whether routine or emergency, the operator should allow the main exhaust fan and the heat source to operate for a short time after the product feed to the dryer has stopped, in order to rid the system of the moisture-laden air. The exhaust fan should then run for an additional period of time after the heat source is shut off, until the internal temperature of the baghouse has cooled to near ambient conditions. Next, the program timer should be set to continue pulsing the filter bags for 10-20 minutes after the main exhaust fan is turned off to fully clean the bags and remove excess dust cake that might absorb remaining ambient moisture. A programmable "cycle-down" function is a standard feature on Sly's standard timer board. Remember that the discharge equipment should be run for the duration of the pulsing cycle to empty the hopper(s).

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Preventative maintenance includes maintaining a stock of replacement parts for critical components such as filter bags, wire cages, timer boards, solenoid valves, and replacement diaphragms. Having these components quickly accessible if operating problems occur minimizes the damage that could occur to other system equipment during an extended failure.

The filter bags should be inspected on a regular schedule to ensure that they are in their best condition to maintain high collection efficiency. The diaphragms should be replaced yearly, especially for continuous operations where many use cycles are recorded.

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Following these guidelines and procedures will ensure long equipment life and reduce unplanned shut-downs resulting from dust collector problems. While the focus of this article is on dryers, the basic principles discussed may be applied to other high temperature applications such as kilns, calciners, smelters, and boilers. Consult the experts at Sly when a question arises about an unusual or difficult application.

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