Making the right choice

Daniel Marshall, Martin Engineering, US, looks at dust collectors and compares central systems to integrated designs.

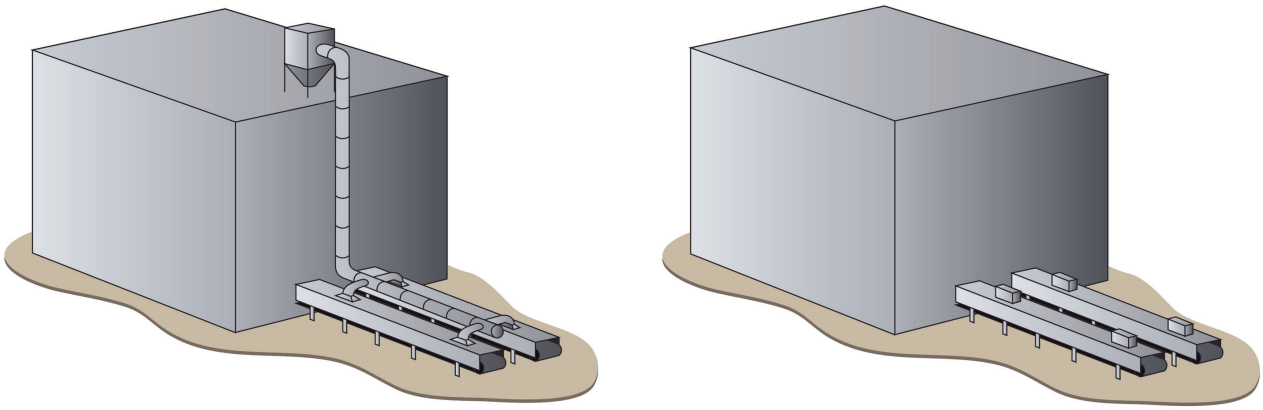
A central dust collector consists of a single assembly containing all fans, filters and a collection hopper. As the name implies, this assembly is located at a central point and connected to all the individual collection points by means of sealed ductwork. This type of filtration system would handle all the dust extracted from the entire conveying system, collecting it for disposal or feeding it back into the process at a convenient point.

Central system

The specifics

The primary components of a central dust collection system are the collector, blower, disposal system and ducting. The collector is the assembly that contains the filter media bags, a system to clean these bags, a collection hopper and a rotary airlock to empty the hopper. Due to the large size and various permitting limitations, these units must typically be located outside of a building.

A collector uses a blower to produce negative pressure, drawing air and dust into the filter media and allowing filtered air to exit. The blower is sized based on the airflow required and the pressure drop the air must overcome. In addition to filter media, the blower must overcome all of the pressure losses of the ducts between the collector and the farthest pickup point. The duct used to connect the collector to the pickup point is sized to prevent any dust from settling out of the air stream. Flow in each section is



A central collection system (left) and integrated air cleaners (right).

Integrated air cleaner installed.

analysed and the duct appropriately sized to maintain the velocity in every branch.

Disadvantages

These ducts can be susceptible to dust settling out of the material stream if the flow changes, which can be caused by design error, air leakage or system alterations. If this occurs, it can release dust into the environment and also change the balance of the system. Accumulated dust in the ductwork contributes to fire and explosion hazards.

Although widely used in many different industries, central collection systems have several other undesirable attributes, including large initial capital investment, high power usage, difficulty in cleaning/maintaining ductwork and the challenge of balancing airflow. In addition, filtered dust requires a method of recirculation or disposal.

Another disadvantage of a central collection system is the inability to isolate individual branches for maintenance or repair, as a flow change in one branch will impact the other parts of the system. Because of this, individual pickup points typically cannot be serviced without system-wide downtime.

The alternative: the integrated air cleaner

An alternative to the central collector is the integrated air cleaner, which contains a suction blower, filtering elements and a filter cleaning system. Instead of a centrally located unit connected to dust generation points via ductwork, this type of cleaner is incorporated into the dust generation point itself. The particles are not extracted, but are instead collected within the enclosure and periodically discharged back into the material stream. Unlike central systems, the integrated approach employs a series of smaller, independently operating units, one at each dust generation point.

The main components of an integrated air cleaning system are the filter housing, filter elements and the blower, which are required at each application point. The filter housing only needs to be large enough to hold the filters for the individual collection point, so it is usually small enough to fit at the pickup location. The integrated system does not need to be located outside and, with ductwork eliminated, a potential source of stagnant fuel is removed. An isolation valve is also unnecessary. Since the filter housing is at the application point and the filtered material is placed back into the material stream, no storage or disposal system is necessary.

Key features

The integrated air cleaner contains an apparatus to clean the filters using a pulse of compressed air. As the filters capture material, it agglomerates against the filter media. When the filter media is pulsed, the material will fall. If it is agglomerated and large enough, it will fall back into the material stream. The pulse system is designed to alternate pulses to each filter element. When one filter is being

pulsed, the adjacent filter is still drawing air. If a pulsed particle is too small to drop out of the air stream, it is immediately pulled into an active filter. This alternated pulsing eliminates the potential for a pulse to create a momentary plume of airborne dust.

Similarities and differences

Like the central system, integrated units use negative pressure, with airflow created by a blower sized to provide the airflow needed for each pickup point. Instead of sucking the air and dust particles out of the unit, as in central dust collectors, the integrated units pull the dust and air in. Since there is no ducting, there are no pressure losses other than the filters that must be accounted for. The power requirements of an integrated air cleaning system are therefore lower than for central collection systems for the same application. Power usage is a major factor in the lifetime cost of ownership.

The integrated air cleaning system utilises a series of independent operating assemblies at each dust generation point, so the loss of a single unit to maintenance will not result in an operation-wide shutdown of the dust collection system. This decentralised approach allows the air cleaners to be incorporated into a maintenance cycle, and no single unit requires a complete system outage for maintenance. The nature of the integrated air cleaner design eliminates many of the disadvantages of a central dust collector, while providing the same level of filtration.

Among recent advancements in air cleaning technology is a new integrated design that features improved filtering and a smaller footprint, helping bulk material handlers minimise airborne dust at belt conveyor loading and transfer points. The Martin® Insertable Air Cleaner is an automatic, self-cleaning unit designed to remove dust from the air in conveyor loading and transfers, silo vents, bucket elevators and screens.

The collector design employs filter elements that are approximately an eighth of the size of filter envelopes in preceding systems. The smaller filter elements allow a significant reduction in the dust collector's footprint, so it can be placed in locations where tight quarters complicate the installation of other systems.

The material filters more effectively and lasts longer – while consuming less energy – than conventional filter bags. The new filters also allow a reduction in fan size to move air through the elements, a factor in reducing the overall power consumption of the collection system.

The new integrated units feature a pulse cleaning system, which uses a short burst of air sent back through the filter to dislodge accumulated material. Filter changes are a no-tool procedure from the clean side of the dust collector. The new designs can eliminate many of the problems associated with central baghouse collection systems, including long runs of ducting, large enclosures, maintenance difficulties and high power consumption. They help solve airborne dust problems by keeping fine particles in the load or returning them to the material stream. WC