by Ryan Bruner

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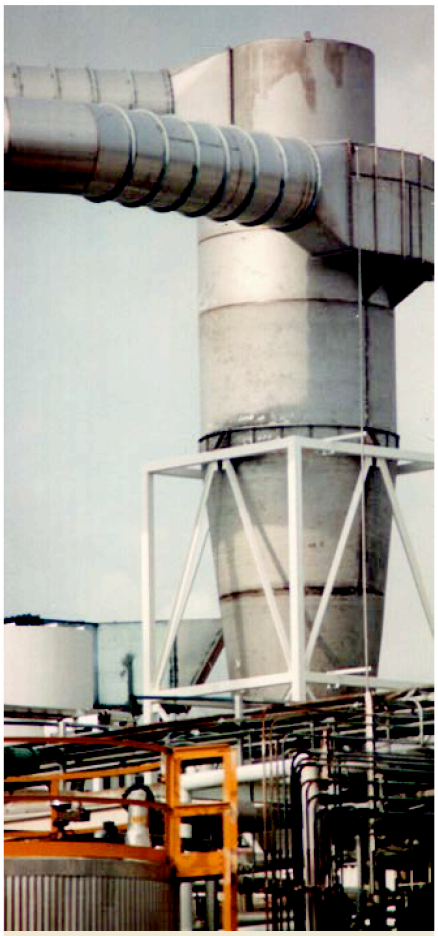
How to Optimize Cyclone Performance

When properly maintained, a well-designed cyclone will deliver the consistent performance you want.



Although maintenance requirements are typically minimal, this capital investment should not be neglected.

With no moving parts, electrical components, or water requirements, your cyclone may be the simplest piece of equipment in the plant. Maintenance requirements are typically minimal. Neglecting your cyclone, however, may cause a reduction in collection efficiency that results in a lower product recovery rate or expensive operational and maintenance problems in your dust collector. It is important to have a periodic inspection procedure in place so that this can be avoided.

What to look for

1. **Abuse** — Cyclones should be periodically inspected for abuse. This is a sign of plugging, a serious problem. When an operator becomes aware of a bridge or plug at the discharge of a cyclone, their first inclination is to beat on it to dislodge the particles. The cyclone, especially those constructed of thin sheet metal, can be easily dented or deformed. With the plug removed, the performance of the cyclone may suffer since uneven surface conditions can disrupt the flow pattern of the spinning air, cause particles to deflect, and send more dust out of the top of the unit.

Deformed cyclones should be repaired and the bridging or plugging problem must be addressed to prevent future abuse. Potential causes of plugging that should be investigated include: non-flush access doors, interior ledges or protrusions, foreign objects, a higher-than-expected particle loading, faulty airlock device, a discharge that is too small, and condensation. If these are ruled out, and the particles are not sticky in nature, impact vibrators, air lances, and strike plates should be installed at the discharge. Poke holes can also provide an easy way to clear plugs.

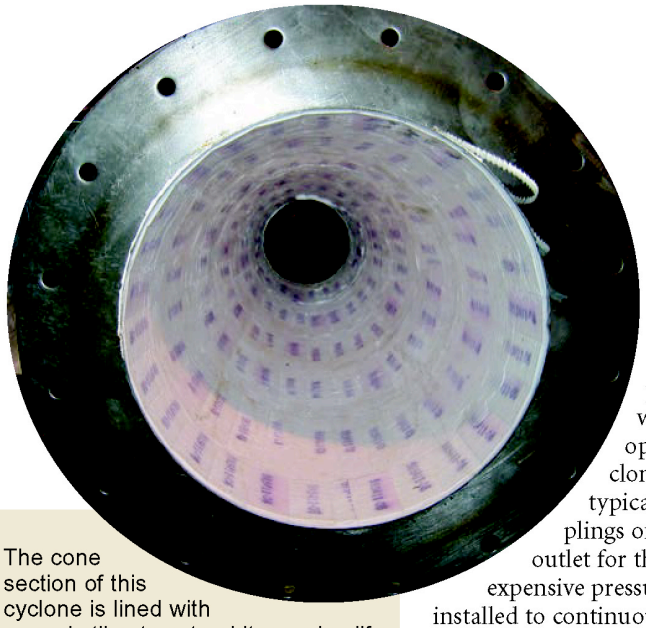
2. **Buildup** — The interior surfaces must be checked for particle buildup since it will disrupt airflow patterns and increase particle emissions. Severe buildup will eventually plug the unit and shutdown the process. If buildup is present, it is important to determine if condensation is forming on the inside walls. Condensation should be suspected on hot air streams with high moisture content, particularly if the cyclone is not insulated.

External insulation is essential on processes that operate near their dew point temperature. If condensation is ruled out, then the particles may simply be too sticky for the cyclone design in use. Features such as polished surfaces or non-stick coatings on the inside may be necessary in the application. In rare cases, material with strong static charges may build up on the walls. Proper equipment grounding often will alleviate this problem.

3. **Wear** — Holes in wear areas may allow air to be sucked into the cyclone

and carry particles out the top of the cyclone. Holes on the interior outlet pipe or vortex finder will allow air and particles to short circuit the spinning action of the cyclone and exit the unit prematurely. Holes are an indication of a wear issue that likely will not go away. The walls of the cyclone should be checked to ensure structural integrity and to determine how widespread the problem is. If the wear is localized, then patching of the area may be performed. It is important to note that any patch must conform to the inside curvature of the cyclone or particle carryover and alternate wear patterns will result. Wear rates are affected by factors such as particle loading, particle size and shape, and air velocities. These factors should be taken into account during initial cyclone selection or when process changes are made to maximize the cyclone service life. In highly abrasive applications, hardened steel or linings may be required. Vulcanized rubber, ceramic tile, and refractory linings have proven to provide a long service life is such severe circumstances.

In large cyclone assemblies, service platforms are used to access cyclone maintenance areas and inspection doors.



The cone section of this cyclone is lined with ceramic tiles to extend its service life in a highly abrasive application.

4. Corrosion — Evidence of corrosion should not be taken lightly. As with wear issues, holes will reduce cyclone performance and the structural integrity of the unit may be compromised. The cause of the metal corrosion must be determined. Using stainless or alloy steel construction may be the only way to avoid the problem.

5. Leaks — All doors, flanges, and airlock devices must be sealed to prevent air from leaking into the cyclone. Leaks not only reduce performance but can also accelerate wear rates and cause plugging. Doors and flanges should be checked regularly and gaskets replaced if necessary. The discharge device at the bottom of the cyclone must be maintained as outlined in the maintenance manual provided by the supplier.

It is very important that the airlock is sealing properly at all times to ensure maximum cyclone performance. Seal strips in rotary airlocks and gasket material in dump valves should be replaced when wear is evident.

6. Process changes — The static pressure drop across the inlet and outlet of the cyclone should be measured to ensure that process parameters are within their normal operating range. Cyclone suppliers will typically include couplings on the gas inlet and outlet for this purpose. An inexpensive pressure gauge can be installed to continuously measure the value. In general, cyclone pressure drops range in value from 4 to 8 inches wg. A reading above this range indicates that the air velocity in the cyclone is high. Although the collection efficiency may be better, wear rates will greatly increase. A lower pressure drop reading indicates a low air velocity and will result in a performance reduction. It may also indicate a leak or a discharge that is not sealing properly.

When all else fails

In many cases, the cyclone design in place is simply not capable of performing adequately. Inherent design flaws may be causing high emissions, high wear rates, or frequent plugging. A cyclone with features tailored to your process may be required. A competent cyclone supplier will let you know what information is needed to properly select a cyclone for your application. Airflow and particle data must be accurately defined at this stage to ensure your new cyclone delivers optimal performance. When properly maintained, a well-designed cyclone will deliver the consistent performance you desire.

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