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**Troubleshooting: Discharge Electrode Suspension Considerations**

In our last troubleshooting article, the topic was the purpose of discharge electrodes and common causes of wire failures. This article discusses suspension considerations encountered by users of weighted wire discharge electrodes.

There are two discharge electrode frames to consider in weighted wire applications:

1. Upper wire frame from which wires are hung
2. Lower wire frame which maintains horizontal stability of wires by fixing the position of the wire and its attached weight

Factoid: Isolating the discharge electrode system from grounded sections of the precipitator is essential for proper performance. Electrical clearances should be maintained at a distance near the plate-to-plate distance. With 9" plate spacing, a distance of 8 inches is usually acceptable, meaning that the discharge system structure should be no closer than 8 inches from the nearest ground source.

The most critical consideration in the design of discharge electrode systems is the alignment of components to set and maintain electrical clearances that maintain high operating voltages.

*Methods of Wire Suspension*

Discharge electrode wires are suspended from the upper wire frame using various hooks, button and key lock arrangements. Similar attachments are used at the lower end of the wire to fasten the weights.

Worn wire frames may fail to support wires by the hooks or attachments as holes and slots can elongate or enlarge and no longer hold the wire. Electrical erosion can occur wherever there is a concentration of high electrical potential caused by a high electrical impedance connection.

*Spring Shrouded Wires*

Discharge electrode wires typically include a shroud around the top and bottom end between collecting plate terminations. The shrouds effectively increase the wire diameter and reduce sparkover potential at the closer tolerances. Wires can be solid- or spring-shrouded and are typically made of solid metal. The shroud is much stiffer than the wire, and the wire itself oscillates due to rapping, gas flow and electrical forces. Wires can fatigue and fracture at the point where the wire enters the stiffer shroud. One patented method of reducing shroud stiffness is the spring steel construction.

Broken wires represent a design and operating challenge. Since the entire wire frame must remain electrically isolated to maintain precipitator performance, any wire failure can result in dramatic loss of collection efficiency.

*Lower Wire Frame Stabilization*

The lower wire frame in weighted wire applications is a critical component in precipitator design. Designed to create an exact mirror image of the upper hanger frame, the lower wire frame maintains centered alignment of the wires from the top to the bottom between the collecting plate electrodes.

Unfortunately, weighted wires have no vertical stability, relying on tensioning by the lower weights and gravity to maintain vertical centering. Since these wires are acted upon by rapping, gals flow and electrical oscillation forces, maintaining alignment is difficult. While the lower wire frame can swing parallel to the gas flow, this is not as serious as side-to-side wire motion. When the lower frame moves across the direction of gas flow, the wires can come in contact with the grounded collecting plates. This shorting causes loss of collecting power and can damage the components by high voltage spark erosion.

There are three generally accepted methods of supporting lower wire frames:

- Hanger Wires
- Truss Arrangements
- Tube Supports

Hanger wires alone do not provide any stabilizing force—they simply support the lower wire frame. They do have the advantage of not reducing the surface collecting area (SCA) and expanding with temperature increases at the same rate as the discharge wires.

Truss arrangements are often constructed of pipe welded into ladder-like or triangular trusses. Truss installation requires removal of some wires and plate, reducing the collection area. They may have differing rates of expansion from the wires and cause wires to slacken and short. Due to their length, they may also permit some swinging and misalignment.

Tubes of heavy pipe welded to each corner of the wire frame (top and bottom) offer some stability, but have limitations similar to truss arrangements.

The most effective stabilization system is the lower wire frame insulating device. This device uses a linkage to the precipitator frame or plates at two points, with a high-voltage insulator to prevent grounding. The insulator material can be ceramic, alumina or Teflon. Unfortunately, all insulators are susceptible to the accumulation of conductive dust which can cause shorting of the frame. In some processes, the dust is not a serious problem, especially if the insulator is used in an upright position.

Teflon insulators are not as effective or as stiff as ceramics, and ceramics are brittle. Selection of the right material depends on the application.

*Oil-Fired Process Stabilization*

For oil-fired precipitator processes, typical ceramic insulators will contaminate quickly due to conductive oil deposits. The oil-fired process precipitator must shut down frequently to clean any deposits from wire frame insulators—a potentially very expensive operation.

This problem can be addressed with the use of a heated, air-purged stabilizer with the insulator isolated from the gas flow.

*Purge Air Lower Wire Frame Stabilizer*

Isolating the insulator exposes it to temperature differential which can result in dewpoint condensation and tracking. Supplementary heaters at the insulator chamber eliminate condensation and a flow of air through an insulated linkage orifice prevents conductive dust from entering the insulator chamber.

*{Learn more about Neundorfer SmartPurge Systems}*

Lower wire frame stabilization in weighted wire precipitator applications requires ongoing attention from designers and operators.  Initial selection of appropriate designs contributes to improved performance and reduced operational downtime.