TROUBLESHOOTING TIP: WIRE FAILURES

Common Wire Failure Problems

Discharge wire failures can be a very serious problem with the potential to force the shutdown of a precipitator's complete electrical field. Common causes of wire failures include:

- Warped plates that change the wire-to-plate distance
- Overvoltage
- Metal fatigue
- Chemical attack
- Mechanical failure
- Eroded wire frames
- Full hoppers
- Improper weight sizes
- Oscillation
- Swinging lower wire frames
- Corrosion
- Improper rapping

Warped Plates

Plates can warp due to manufacturing-induced stress, corrosion and extreme heat. Warped plates decrease the clearances to discharge wires, forcing a reduction in applied voltage and reduction in collection efficiency. The illustration below shows how constant sparking erodes the wire until it thins out or "pencils" and then breaks.

Corrective actions may include realignment/straightening or complete replacement. Corroded plates lose their strength and responsiveness to rapping and are not typically good candidates for straightening.

Overvoltage

High voltage applications to discharge wires increase sparkover potential. This can result in electrical erosion at the point of sparkover, weakening the wire and increasing the likelihood of wire breakage.

Metal Fatigue

Electric and gas flow forces within a precipitator cause constant wire oscillation that can harden the wire material over time, making it brittle and susceptible to breakage.

Chemical Attack and Temperature Influences

Many chemicals are corrosive and can contribute to wire failure. To maximize resistance to failure, wire material composition should be selected as a function of the precipitator environment and potential chemical exposure.

Temperature also influences chemical activity. Temperatures that are too low can result in damage to wires as the acid dew point is reached. In contrast, at high temperatures of 600º or above, metal wires can elongate and result in wire slackening.

Mechanical Failure

Discharge wires can fail due to manufacturing defects in the wire material quality itself or as a result of improper attachment of hooks, buttons or shrouds. In addition, poorly designed attachment devices can contribute to spark erosion and wear.

Eroded Wire Frames

Worn wire frames fail to support wires by hooks or attachments because holes or openings can elongate or enlarge and the wire is no longer held firmly in place. Electrical erosion can occur wherever there is a concentration of high electrical potential. Sharp edges on wire assembly parts, including shrouds, also contribute to wire frame erosion.

Full Hoppers

The collected particulate in full hoppers ultimately can push up the weights meant to keep wires taut, causing the wires to slacken or even short out.

Improper Weight Sizes

Weights that are too light to keep wires taut allow increased oscillation which leads to increased sparking.

Oscillation

Discharge wires oscillate in response to applied voltage as well as gas flow and ineffective wire weights, resulting in the likelihood of wire failure over time.

Swinging Lower Wire Frames

Lower wire frames are typically suspended from the upper frames. Gas flow and other disturbances can cause these lower frames to swing and reduce electrical clearances.

Corrosion

Moisture is the most common corrosive in discharge electrode systems, contributing to rusting of carbon steel wires. Acids can also be highly corrosive. To counteract many corrosives, the use of chrome molybdenum alloys or stainless steel wires is required.

Improper Rapping

Improper rapping can result in hardening of the electrode material, making wires brittle and more susceptible to failure.

Failure Analysis

The discharge electrode system should be examined whenever power is reduced in a precipitator. If it is determined that the wires are failing or have failed, physical inspection of the position occupied is necessary to determine if there are close clearances that could lead to spark erosion. Every effort should be made to document the wire location and time of failure using a precipitator plan view showing all wires by field location and position.

If wire failures occur in groups served by one transformer-rectifier (T/R) set, close clearances or swinging wire frames are the likely cause. Random wire failures can occur for many of the reasons previously described.

Should failed wires cause a short, the problem is serious and may require an entire field shutdown. Excessive failures provide sufficient reason for shutdown and internal investigation.

Rules to Follow in a Wire Failure:

- Keep a record of the failure date and location
- Retain the failed wire for analysis
- Provide an original, unused wire from the same source as the failed wire, for comparative analysis
- Identify the cause of the failure and take corrective action

Corrective Action for Wire Failures

Corrective action for wire failures depends on the root cause. Multiple actions may be required to prevent future failures. Failure analysis may involve a combination of on-site inspection and physical analysis of the broken wire.

Neundorfer has an experienced team of engineers to assist in the identification of wire failures and the implementation of cost effective, practical solutions. Neundorfer also manufactures new discharge electrode wires. For more information about Neundorfer wire products and services, call (440) 942-8990.