Wet Electrostatic Precipitators Ideal Choice for Gas Cleaning in Sulfuric Acid Plants

New and proposed pollution regulations are restricting particulate and acid gas emissions to extremely low levels. Because of that, sulfuric acid plants are being installed to remove and utilize SO_2 in gases resulting from the roasting of sulfide ores, smelting of ores, and burning or regeneration of spent acid or acid sludge from petroleum refining.

To prevent the formation of "black" or contaminated acid and to protect the catalyst beds from fouling and plugging, wet electrostatic precipitators are utilized to clean the off-gases before entry into the acid plant. The acid plants that must handle impure sulfur dioxide gases such as those emitted from metallurgical processes like ore roasters, flash smelters and spent acid regeneration, require the removal of acid mist and residual dust and fume before the gases enter the drying tower.

Conventional scrubbing systems (wet or dry) are generally not effective in controlling sub micron emissions, consisting primarily of acid gas mists, sub micron particulates and condensed organics. Wet tubular electrostatic precipitators, because of their ability to generate multi-staged charging and strong electrical fields in a wet, cooled atmosphere, have been shown effective in cleaning the flue gas.

Beltran Technologies Inc. has developed a unique wet tubular precipitator as a result of considerable research and development. The typical Beltran wet ESP is a vertical-flow hexagonal or rectangular tube type precipitator.

Typically the flue gases enter at the bottom and flow upward through the precipitator. There are generally two sets of spray headers, whereby the first set continually cools and saturates the flue gases, if necessary. The second set of spray headers are at the top and directly below the collector that washes the collector and electrodes. These are operated on a periodic, as needed basis.

The multi-stage tubular precipitator consists of a series of ionizing sections and a collection section. The discharge electrode is in the form of a rod or tube with a number of sharp corona generating discharge points. Various collecting tube geometries have been utilized over the years, the most common being the round. The square configuration and/or the hexagonal shape is chosen because these geometries are much more space efficient than the round shape, and produce a greater collection efficiency in a given volume.

The Beltran wet precipitator uses solid ionizing rods instead of wires. Also, the unique electrode design allows for generation of a corona field four to five times more intense than standard wet or dry ESPs. This higher current and field strength results in higher particle migration velocities that translate into a higher efficiency or reduced collector area.

Solid particulate matter and mist droplets that enter the electrostatic section are charged by the high voltage and current produced by the electrode and collected on the grounded plates. Most of the particulates are flushed down into the bottom of the housing.

The high voltage insulators are kept clean continuously using a purge-air system. These features result in very low maintenance. Optional internal scrubbers to remove acid gases can be installed in the lower part of the housing, for tail gas cleaning. In some cases wet ESPs have been mounted on top of existing scrubbers as a "polishing" device.

Since fine particles do not have a significant mass, they generally go through scrubbers or other low-pressure drop devices, with minimal collection. Also, high pressure drop is associated

with scrubbers and baghouses. The wet ESP has less than a one-inch water column drop and is low in maintenance.

The wet ESP provides low energy collection of submicron particles regardless of the physical or chemical nature of the collected material. Due to the high dust and acid removal requirements that are necessary, the wet electrostatic precipitators operate at collection efficiencies of 99.7 percent to 99.9 percent.

The corrosive nature of the flue gases demands that special attention be given to the materials of construction. Therefore the Beltran wet ESPs are fabricated using FRP (Fiberglass Reinforced Plastic) or high nickel-chromium alloys. While most electrostatic precipitators used for acid mist applications have been constructed from lead, FRP precipitators are less expensive, easier to construct and to maintain, and are extremely corrosion resistant. The electrically conductive sections of the ESP are made from special conductive FRP.

The wet electrostatic precipitator can be applied to various metallurgical processes such as a zinc roasting plant, a nickel flash smelter and a copper flash smelter, as well as a sulfuric acid regeneration plant. The flash smelters are of the Outokumpo design with oxygen enhanced air. The acid plants vary in size from 340-2,000 tons per day of acid. Beltran's more than 20 years of experience in manufacturing wet ESP's show that this design is the most efficient acid mist and sub-micron particulate collector. Its' collection mechanism is electrical charging as opposed to inertia impaction in scrubbers or other gas cleaning devices.

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