MHI Value Propositon 2003

- PRODUCT: absorber
- INDUSTRY Power-coal
- VALUE PROPOSITION: Double Contact Flow absorber is more efficient and uses less slurry than alternatives

MHI is the Worlds Largest FGD Scrubber Supplier

MHI has been supplying FGD scrubber systems for more than 4 decades and is the worlds largest supplier. Systems have been supplied in many countries around the world. Cumulative contract totals are many billions of dollars.

The company provides the process knowledge and proprietary hardware but works with local partners to supply the balance of plant and construction.

Competitors mostly supply tower systems which require high volumes of slurry to contact and absorb the SO2.

MHI uses a double contact approach for more intensive contact and higher efficiency for a given slurry volume.

Due to the highly abrasive and corrosive environment it is necessary to utilize appropriate materials.

With its long experience MHI has optimized the material selection.

Years of Operational Experience Leveraged for Smooth Scrubber Operation

- In the limestone gypsum system, the SO2i is captured with limestone to form gypsum particles. There is the tendency for gypsum to precipitate in the scrubber and cause scaling
- It is necessary to control pH, slurry bleed and other parameters to prevent scaling while optimizing removal efficiency
- Instrumentation and operational protocols have been developed to ensure that scrubber reliability is equal to that of the balance of three plants.
- The scrubbing action creates large quantities of droplets entrained in the exiting gas. MHI has developed demisters which resist plugging, are efficient, and have minimal pressure drop

Double Contact Flow Absorber

Scrubber Details

- As the flue gas enters the top of the first tower of the DCFS twin tower design (shown in Figure 1), the wet dry interface is located nearly 8 feet into the top part of the vessel. This interface is washed routinely with fresh make-up water to minimize build-up of flyash entrained in the flue gas. The flue gas encounters the top of the fountain spray as the gas flows countercurrent to the spray in the first of the twin towers.
- The recycle slurry is spouted upwards in fountain-like spray by multiple single-stage nozzles installed on a single spray header located at the lower section of the first and second towers. This fountain or liquid column in the DCFS contacts the flue gas as it proceeds countercurrent to the liquid spray and again co-current as liquid and gas flow downward together.
- This “Double Contact” provides for intimate contact for absorption of SO_2, excellent utilization of the limestone reagent, and a very high level of removal of incoming flyash.

More Scrubber System Details

- As the gas leaves the first tower, it traverses the top of slurry in the reaction tank before entering the second tower. In the second tower, the flue gas passes co-current to the flow of the fountain spray and countercurrent to falling droplets of slurry. This additional second tower and “double contact” design provides the additional gas-liquid contact such that the resulting SO_2 removal efficiency can be as high as 99.9 percent. The gas velocity in the first tower is typically between 15 and 30 fps, while the velocity in the second tower is typically between 14 and 20 fps. This makes the absorber tower very compact and cost effective.
- The absorber tower is equipped with a single-level spray header in each tower. Low-pressure silicon carbide nozzles are used to provide a fountain-like spray reaching about 15 ft to 30 ft in height. The spray headers are connected to a single recycle header pipe that in turn is connected to the recycle pumps. A pump suction deflection/screening plate is located in close proximity to the pump suction and spans the entire side of the reaction tank.
- The reaction tank operates at 30 percent solids which promotes gypsum crystal growth and significantly reduces gypsum scaling. The twin tower design has the added advantage of using top-mounted agitators, which also double as air spargers. This proprietary design, called the Air Rotary Sparger or “ARS,” is highly efficient in terms of mixing and oxidation.

Modular Approach Allows Equipment Standardization

- After the flue gas exits the spray zone of the second tower, it passes through a two-stage vertical flow mist eliminator. As the DCFS FGD system operates at 30 percent suspended solids, the system does not require a primary dewatering system. The absorber bleed pumps can feed directly to a belt-filter or drum filter for dewatering to desired moisture level.
- The design of the MHI DCFS system is highly standardized, and the size of the absorber tower only expands in one direction to accommodate different volumes of flue gas. By using a modular approach and multiple absorber sizes in steps of 200 MWe, the cost of the FGD retrofit project can be reduced substantially. Finally, in the MHI FGD design, all recycle pumps, gearboxes and motors are identical since the DCFS design only uses one spray header at one elevation, exposing all recycle pumps to the same pump head pressure. The modularization approach makes it possible to benefit from standardized equipment across a fleet of FGD systems basically independent of absorber size. Hence, a shared or a common spare parts inventory is feasible.