RJM-Beaumont™

NEXT GENERATION MULTI-POLLUTANT TECHNOLOGY

Your Single Source for Multi-Pollutant Emission Control

The RJM-Beaumont™ process offers a next generation semi-dry scrubbing equipment to control acid gases, heavy metals and particulate matter. Combined with RJM-LT™ for NOx reduction, RJM now offers a single source for low-cost and highly reliable multi-pollutant emission control technology.

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RJM INNOVATIVE ENERGY SOLUTIONS

The RJM-Beaumont™ Process

The RJM-Beaumont™ process removes sulfur dioxide (SO_2), mercury and fine particulate matter from exhaust gases. Other key pollutants controlled by the process are Hydrochloric Acid (HCl), Sulfur trioxide (SO_3), sulfuric acid (H_2SO_4), ash and toxic metals.

The RJM-Beaumont™ process includes a patented semi-dry Flue Gas Desulfurization (FGD) control system and a pulse fabric filter, designed to achieve high removal efficiencies at lower capital and operating costs compared to conventional wet FGD systems.

When combined with the RJM-LT™, the RJM-Beaumont™ process offers a cost-effective multi-pollutant control technology for utilities, industrial boilers, steel and cement industries. The RJM-LT™ is a layered approach to NOx removal.

How Does the RJM-Beaumont™ Process Work?

The RJM-Beaumont™ flash drying process uses a patented 'Reactor' and a 'Pulse Fabric Filter,' described below to control multi-pollutants.

SO_2 Control

Flash Drying Technology

The Rapid Absorption Process (RAP) reactor intimately mixes semi-dry lime sorbent in the flue gas stream to react with SO_2 and SO_3 gases. The resulting material is **flash dried** and collected in a fabric filter and recycled back into the reactor.

A unique feature of the Rapid Absorption Process is that the entire process takes place at gas temperatures **above saturation**, which protects the back-end system components from corrosion and buildup.

Other attractive features of the RJM-Beaumont™ process include:

- Lower Capital Costs (as low as $33/kW)
    - Savings of 60%-70% over wet FGDs
    - Smaller Footprint
    - Non-Exotic Materials
    - Simplified Controls
- Lower Operating Costs (as low as $173/ton)
    - Reduced Maintenance Cost
    - No Buildups on the Walls of the Reactor
    - Reduced Levels of Material Handling
    - Lower Volume of Lime Sorbent – Higher Utilization
    - Reduced Power Requirements
- Phase-In Flexibility to Meet Compliance Targets

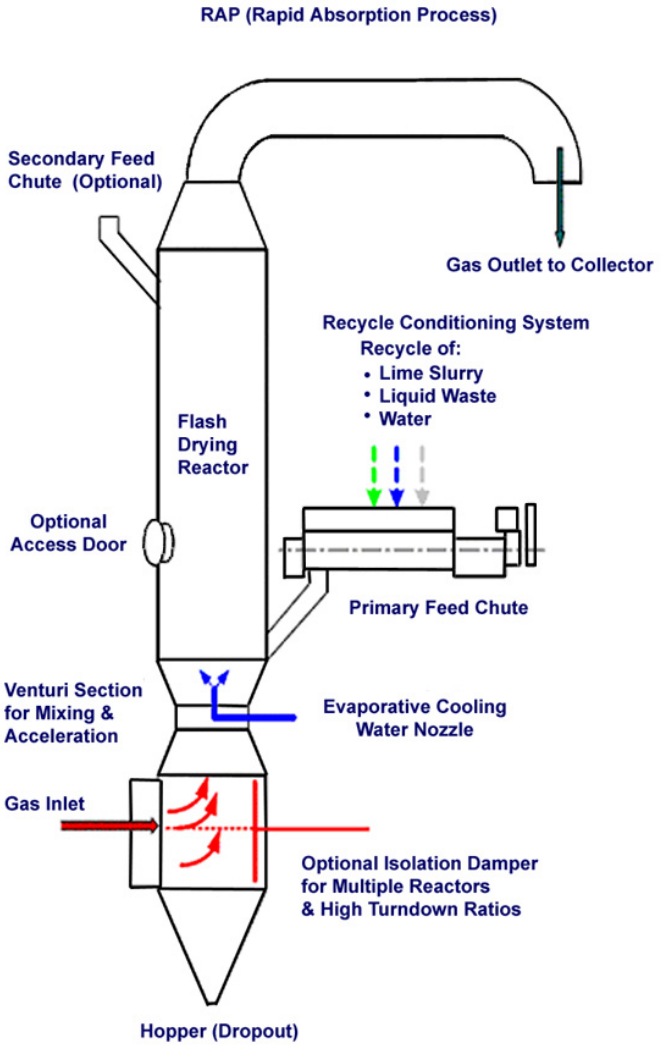

Figure 1: The recycle material enters the reactor above the venturi. The lime sorbent is introduced through the chute and immediately flash dries leaving a dried material that is carried to the final filter. By spraying the lime slurry outside the reactor, the RJM- Beaumont™ process eliminates buildup on the walls of the reactor and lowers maintenance costs.

High SO_2 Removal at a Low Cost/kW

The capital cost for the RJM-Beaumont™ Process is significantly lower than that of a wet FGD SO_2 scrubber. Estimated savings in capital costs range from 60% - 70%. For example, in a 500 MW unit, the RJM-Beaumont™ process costs as low as $33/kW compared to the $100 to $130/kW for a wet FGD scrubbing system. Additionally, the RJM-Beaumont™ process is normally furnished in modules and therefore the cost/kW remains relatively constant across different sizes.

SO_2 Removal Costs for a Sample 500 MW Unit
(All costs are budget basis and will vary by individual unit)

Unit Data	**Sizing**
Size Plant ACFM	1,741,879
Hours of Operation (Yr)	8,000
MMBtu's/Hr Rating	4,992
Tons/Yr SOx Removed	61,845
Disposal (Tons/Yr)	227,055
Sorbent - Tons/Year	81,695
Water (gal/hr)	22,963
Capital Costs	
RAP System	$11,080,240
Erection	$5,254,592
Total	**$16,334,832**
Cost in $/kW	**$33**
Operating Costs	
Capital Recovery	$1,277,820
Water Cost	$918,533
CaO Costs	$4,901,699
kw - Booster Fan	$464,640
kw - Other	$557,440
Maintenance Costs	$332,407
Disposal Costs	$2,270,549
Total	**$ 10,723,088**
Cost in $/Ton Removed	**$173**

Assumptions

1. Power Costs at $0.04/kWh
2. Water Costs at $0.005 per gallon
3. Maintenance Costs assumed at 3% Equipment Cost
4. Disposal Cost at $10/ton
5. Lime Sorbent Cost at $60/ton
6. Equipment Life at 25 years
7. Interest Rate at 6%

Particulate Matter (PM) Control

The RJM-Beaumont™ process applies a pulse-jet fabric filter system to collect solids for recycle and discharge. Medium (45 PSIG) and high (90 PSIG) pressure pulse systems are available. The RJM-Beaumont™ process also offers a reverse gas cleaning system where dust is collected inside the bag instead of outside as in the pulse-jet fabric filter design.

Flexible features of the RJM-Beaumont™ process for PM control include:

- High Pressure Cleaning
- Medium Pressure Cleaning
- Variable Bag Spacing
- On-Line Cleaning
- Off Line Cleaning
- Combination Cleaning

High-Pressure Cleaning Units

The RJM-Beaumont™ process offers bags with nominal 5 inch and 6 inch diameter using high-pressure cleaning. These designs include **variable bag spacing** in both directions, **online and off-line cleaning** along with a reduced-flow cleaning mode.

Medium-Pressure Cleaning Units

The RJM-Beaumont™ medium–pressure process varies the pulse cleaning pressure downward while increasing the flow utilizing large pulse cleaning valves. This design includes similar bag sizes as well as variable bag spacing. Additionally, to improve pressure drop and removal efficiency, the RJM-Beaumont™ process can incorporate electrostatic charging rods into the pulse baghouse.

Isolation Valves

Poppet valves are used when cleaning off-line. These valves provide metal-to-metal seals and low leakage as required for cleaning. They are used with pulse and reverse gas cleaning designs. The hopper arrangement along with inlet size and location into the hopper is of great importance in proper baghouse design. The RJM- Beaumont™

process uses a plate type rectangular valve for this purpose. The valve must be properly incorporated into the inlet manifold to protect against excessive build-up and fallout within the manifold.

Mercury Control

The RJM-Beaumont™ process introduces a special oxidized calcium sorbent into the reactor to remove gaseous mercury by up to 90%. A proprietary Dry Absorption Process is used to introduce the oxidized calcium sorbents and cool the gases to a reactive temperature (200°F). The sorbents are carried into the pulse type fabric filter where a reactive cake is built on the surface of the bags.

The oxidized calcium sorbents have been successfully tested for their ability to remove Elemental Mercury, SO_2, SO_3, and NOx. They offer an economical alternative to carbon in mercury removal.

RJM-LT™ for NOx Removal

The RJM-Beaumont™ process combined with the RJM-LT™ offers a complete multi-pollutant control system. The RJM-LT™ system for NOx removal is designed to achieve upto 90% NOx removal from baseline emissions in fossil fuel fired boilers. The RJM-LT™ can be employed as the sole NOx removal system or can be used in conjunction with an SCR to reduce annual O&M costs. The technologies used in the RJM-LT™ NOx removal process include:

- Burner Modifications
- Overfire Air System
- NOx Tempering™
- Selective Non Catalytic Reduction (SNCR)
- RJM-AC™ (Rich Reagent Injection)
- Flue Gas Recirculation (FGR & IFGR)

Multi-Pollutant Emission Control

RJM offers a Single Source for Your Emission Control Needs

The RJM-Beaumont ™ process in combination with the RJM-LT™ offers a patented and cost-effective solution for multi-pollutant emission control. It offers tremendous value to power producers because it can efficiently bring NOx and SO_2 emissions into environmental compliance without the high capital and operational costs associated with conventional SCRs or wet FGD systems. Moreover, with mercury and PM emissions coming under greater regulatory scrutiny, RJM's technologies are uniquely positioned to offer the least cost approach to multi-pollutant control.

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