

The Application of a New Wet Scrubber as a Wet Flue Gas Desulfurization System

Optromix Company presents the new type of wet scrubber – the multi vortex wet scrubber. The multi vortex wet scrubber can be used to remove dangerous gases, particulate matter, vapors and other contaminants from the air to meet EPA and OSHA requirements. The difference of the multi vortex wet scrubber is that it uses up to 10 times less cleaning liquid than a typical wet scrubber and it has no scale up issues. This water- and reagent-saving device has found wide applications in wet flue gas desulfurization (WFGD).

Introduction

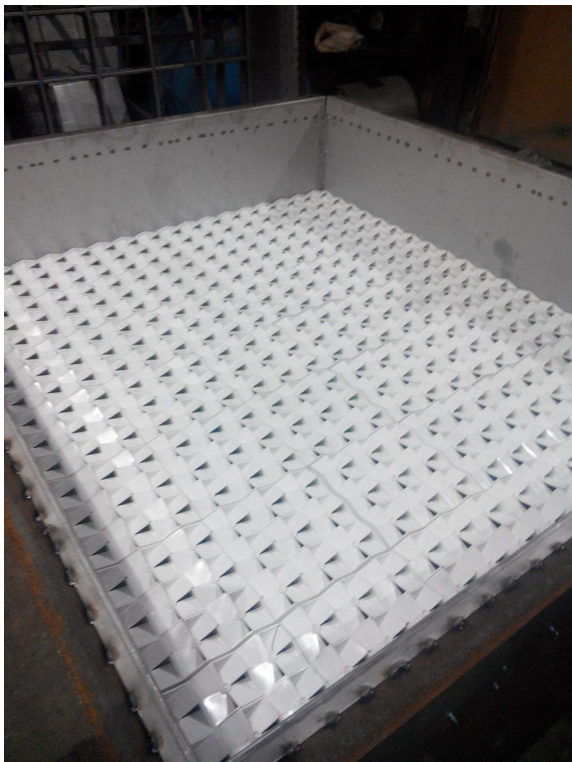


Figure 1. The polypropylene dispersive grating unit ready to be installed inside the retrofitted foam scrubber.

The multi vortex wet scrubber is a new generation of foam wet scrubbers that has a very stable operation in harsh environments using cleaning liquid with high mineralization and high impurities content. The multi vortex wet scrubber can work for extended periods of time using the recirculating cleaning liquid. The multi vortex wet scrubber decreases liquid consumption up to 10 times compared to a typical foam wet scrubber.

The cleaning liquid does not require a special treatment and may contain solids (e.g. sand, small rocks) and other contaminants. For this reason the cleaning liquid may be used after other process cycles, thus achieving considerable savings.

The self-cleaning grating is the multi vortex wet scrubbercore patented technology. It is usually made of plastic (polypropylene) or stainless steel (for high temperature applications >300°F). This grating does not fray and does not grow scaling, even when using cleaning liquid with mineralization of up to 15.6 lb/cf

The self-cleaning grating is assembled from the standard square-shaped elements. The grating size is determined by the required system capacity. Structurally, the grating consists of divergent holes formed by vanes to provide a turbulent stabilization of the foam layer without external stabilizers. The multi vortex wet scrubber capacity may vary from 600 cfm to 150,000 cfm. It is possible to place several grating layers one above another in the multi vortex wet scrubber system to achieve the required efficiency.

FGD Application in Aluminum Production

The multi vortex wet scrubber system was applied to retrofit existing WFGD foam scrubbers at the Aluminum Plant owned by the RUSAL Corporation. The foam scrubbers capacity was 20,500 cfm each.

The Aluminium plant uses recirculating cleaning liquid from other technological processes with the mineralization of up to 15.6 lb/cf. That mineralized liquid caused the regular rescaling of the foam scrubbers. Every month the foam scrubber had to be stopped for service due to efficiency decreasing and hydraulic gradient rising. The client did not consider to dismantle the old scrubber. Thus we decide to retrofit it with scroiler system.

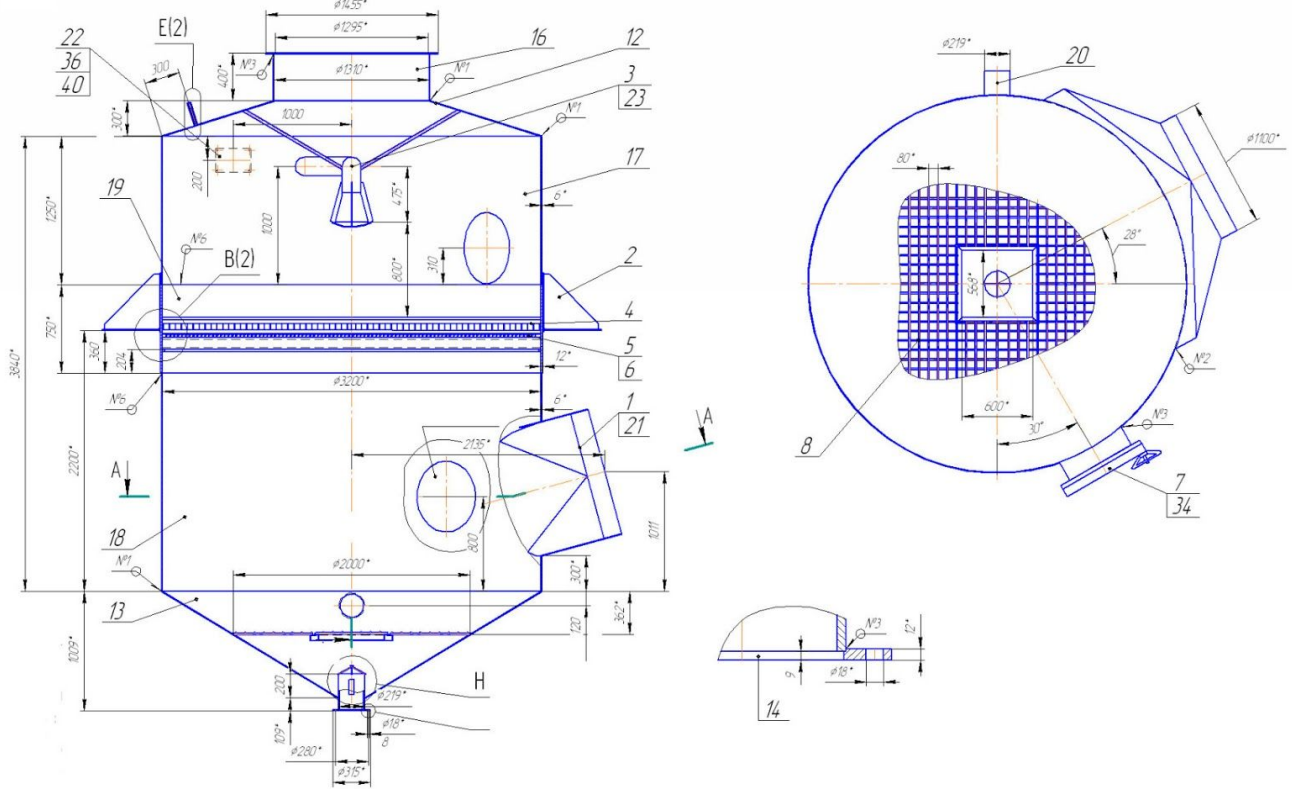


Figure 2. The multi vortex wet scrubber system design inside the foam scrubber body (in mm)

We designed the project to replace the foam grating with the multi vortex wet scrubber grating. The design and calculations took 1 month. The calculated SO₂ treatment quality satisfied the client.

Projected retrofit specifications

Capacity	35,000 m ³ /h	20,500 cfm
Peak Capacity	50,000 m ³ /h	29,500 cfm
Working temperature	up to 130°C	up to 266°F
Inside overpressure	4,000 Pa	0.58 psi
Inside overpressure, max	10,000 Pa	1.45 psi
Reagent	Na ₂ CO ₃	
Treatment quality	more than 95.0%	

The manufacturing of the multi vortex wet scrubber system took 2 month. The dispersive grating was made of polypropylene. The packed bed of the foam scrubber was cut out and the dispersive grating with the other multi vortex wet scrubber elements were installed instead. The installation was performed in 3 days.

During the commissioning period of 2 weeks it was shown that the measured treatment quality is higher than projected.

Input temperature	85°C	185°F
Input pollutant concentration	150±37 mg/m ³	
Normal contaminated air flow	61,040 m ³ /h (N)	35,930 cfm
Reagent consumption	19.1 m ³ /h	11.2 cfm
Output temperature	37°C	99°F
Pressure drop	0.15 kPa	0.02 psi
Output pollutant concentration	5±1 mg/m ³	
SO ₂ treatment quality	96.7%	

The new multi vortex wet scrubber system was put to the test considering dispersive grating self-cleaning properties. During the testing period the multi vortex wet scrubber device was in process continuously. Once per month the multi vortex wet scrubber was stopped to measure the scaling inside the reaction chamber. The result was constant from month to month during the whole year: there were no significant scaling to rise the hydraulic gradient and to decrease the efficiency. The efficiency were remaining exactly the same during the whole period.



Figure 3. The multi vortex wet scrubber dispersive grating after one year of the continuous air treatment process. The gaps in the grating elements are clearly visible.

After the testing period the multi vortex wet scrubber system retrofitted to the old foam scrubber continues to work for half a year already without service downtimes. The Aluminium Plant retrofitted all the foam scrubbers by the multi vortex wet scrubber. Now RUSAL Corporation ask Optromix to retrofit foam scrubbers at the other Aluminium Plant to perform WFGD.

This example demonstrates the multi vortex wet scrubber self-cleaning properties that prevents scaling in heavily mineralized media. Optromix has other Scroiler WFGD installations which shows that these properties are not subjected by the reagent formula and is suitable for the gypsum production. The multi vortex wet scrubber can be installed to perform WFGD process at coal power plants, aluminum and iron production.