Retrofitted GTC Performs Better than New

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Abstract

In 2018 the alumina dry scrubber (GTC) of the K3 potline at Hydro Karmøy in Norway were upgraded with a new alumina distribution system, a new reactor technology and extended surface (star-type) filter bags. The new reactor design had been tested for a year in a pilot filter prior to full conversion of the remaining 11 filter compartments. The reactor designed in the early 80s was replaced with a new design called TurboBed with a booster section, followed by turbulent gas flow zone with injection of fresh and recycled alumina, and followed by a lean phase reactor section transporting gas and alumina into the filter section with a nest of extended surface filter bags.

This paper reports the findings and improvements of the system as detected over the years it has been in operation. A significant improvement of the HF, fluoride and dust capture and recovery is observed by emission monitoring. The rate of repair in form of patching eroded reactor steel surfaces has been eliminated thereby lowering the maintenance costs. Rate of scale formation in the reactor has decreased substantially and it is now in 1-2 days easily removed from the reactor inspection door. The filter bags were replaced from cylindrical bags to extended surface (star-type) bags. This modification almost doubled the filtration surface resulting in a lower filter resistance and pressure drop. This allowed for an increased gas flow through the gas treatment plant to increase the exhaust rate from the pots. This nicely compensated for a much-needed increase in exhaust rates due to pot amperage increase being implemented over some years with no increase in flow rates. Furthermore, the increased gas flow from the pots allowed for improved control of the emissions to the potroom and further to the environment at levels well below limits of license to operate.

Keywords: GTC retrofit, Cell emissions reduction, Dry scrubber reactor, Turbo Bed, Extended surface filter bags.

1. Introduction

The Hydro Karmøy Metal Plant expanded its Soederberg operation (Lines K1 and K2) in 1982 with a Prebake line (K3) of 110 pots using AP 18 pot technology. The K3 Gas Treatment Centre (GTC) of Flakt technology included dry scrubbing with alumina and a seawater scrubber for SO_2 control.

Over the years the Karmøy plant has undergone several expansions with the K4 and K5 potlines whilst the Søderberg operation has been terminated. In recent years (2018) Hydro expanded the plant further with the introduction of the Karmøy Technology Pilot (KTP) with the goal to demonstrate the most climate and energy efficient aluminium production technology in the world. The plant total aluminium production is 280 000 t/y.

Figure 1. Hydro Karmøy metal plant.

2. Modernization of the K3 Dry Scrubber

Hydro's K3 alumina dry scrubber was originally installed by Fläkt in the late 70´s and after more than 30 years of operation was experiencing performance shortcomings with regard to removal efficiency and extensive maintenance. The emission compliance was never threatened as the downstream wet scrubber always ensured low emissions to the ambient. Along with Hydro´s ambitious plans for pot amperage increases and the need for higher pot exhausts, it was decided in 2015 to modernize the dry scrubber.

In 2015 the increased challenges of the dry scrubber showed higher emission from the filters, which were well above design values. Also, the wear of the reactors had become an operational issue. Hydro and Neatec agreed to test out Neatec´s new reactor technology (TurboBed) by retrofitting one of the 12 Fläkt reactor/filter compartments of the K3 dry scrubber.

2.1 The Fläkt Dry Scrubber Reactor/Filter Design

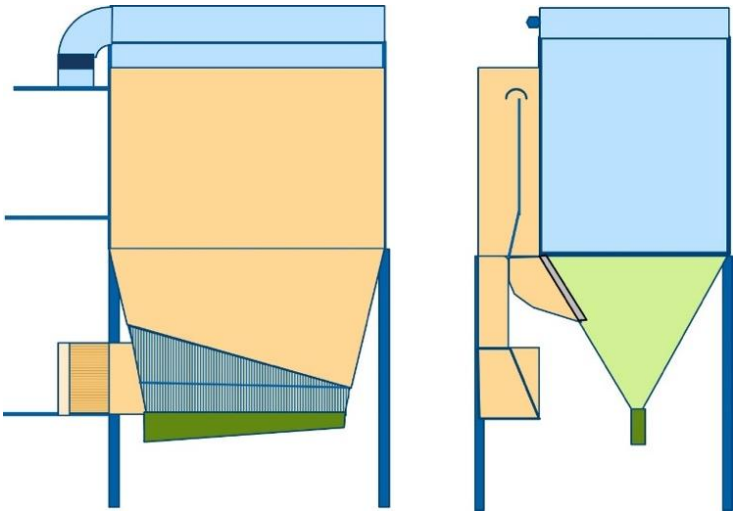

Figure 2. The original K3 reactor/filter configuration.

The plant has installed emission sensors (HF and Dust) across all GTCs and PlantPAx® integrated control and information solution ensures easy access and real time visualization of plant operational key data as seen in Figure 18. This allows for daily target settings during operators and management early morning meetings.

Through the implementation of the information system and the operators´ dedication to use the data for further improvements of emissions and GTC operation lead to the Hydro´s internal award for sustainability in 2022.

There is also on-going testing of bags from a different manufacturer that indicate a further extended bag life.

5. Conclusion

The retrofit and upgrade in 2018 of the dry scrubber for the GTC K3 at the Karmøy Metal Plant has been a success. The dry scrubber technology from the early 80´s was modernized with new reactor systems (TurboBed), new fresh alumina distribution system, recirculation feeders and secondary alumina airslide system, enlarged filter hopper capacity for alumina storage and extended surface bags (star bags).

The dry scrubber HF emission was reduced to 1/10 with emission levels lower than 0.5 mg/Nm^3 and regularly between 0.1 and 0.3 mg/Nm^3. Dust emissions were consistently below 1.0 mg/Nm^3. The emissions show levels on par or even lower than the new GTC at KTP.

Maintenance costs have been significantly reduced and scaling issues are now nearly non-existent. Erosion of reactor steel surfaces is eliminated.

6. References

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