Performance of an Impact Crusher used as an Alternative to Produce Anode-Covering Crushed Bath during Autogenous Mill Refurbishment

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Abstract

This work presents the performance of an impact crusher used to produce 300 tons daily of crushed bath for anode covering. The impact crusher has been tested for 10 months consecutively in the Sohar Aluminum smelter, beating the initial original equipment manufacturer (OEM) specifications and life expectancy.

The impact crusher was initially selected as a short-term compact alternative to temporary replace an aging and defective autogenous mill during its change-out for a similar model. The study describes the contingency plan carried out to prepare for the changes during actual production cycles, the performance tests and setting, the maintenance schedule, the improvement in terms of operation, the learning curve in terms of inlet product acceptance and final product size.

The use of the impact crusher as an alternative was a real success. Unlike an autogenous mill, it permitted to test various setting to increase the crushed bath particle size in simple ways. The crusher proved reliable, and it even enabled to process every source of bath materials from the bath of the pots, butts, crucibles, basement, and dross consistently with light preventive maintenance schedule.

Keywords: Autogenous mill, Impact crusher, Crushed bath size.

1. Autogenous Mill Condition Legacy & Replacement

Sohar Aluminium smelter was designed with a facility to crush bath for anode covering and for crushing of tapped bath. The breaker function, an autogenous mill (AM), is to crush 250 to 300 t of bath daily to supply the potrooms with bath at a certain particle size. Figure 1 shows the AM. The granulometry of the bath covering the anodes, and its consistency are both critical for the crusting behavior, the pot heat balance [1] and the control of the liquid bath level, as pointed out by Taylor [2] and Gudmundson [3]. As per Aluminium Pechiney specifications, the optimum granulometry of the anode cover bath once crushed must be for less than 5 % , smaller than 0.75 mm and for at least 50 % , greater than 3.15 mm. The crushed bath granulometry plays a role in protecting the anode against the air oxidation, regulating the heat losses above the top of the anode, forming the desirable crust on and around the anode, scrubbing the fluorides emission,

contributing to the liquid bath level adjustment, as well as the covering operation quality and velocity [4].

Figure 1. Pictures of the 2013 autogenous mill.

At the beginning of its operation, the presence of heavy pieces of aluminum trapped in the tapped bath damaged the AM before a detection system was implemented. In 2013, it was decided to replace the gravity breaker with a new one, for this reason. Unfortunately, the improvement did not last long. The new AM has also run into increased frequent and recurrent problems. Persistent vibration issues and miscellaneous failures are summed up in Figures 2-4. A motion amplification recording system was applied to identify the reason of the failures. The foundation itself was in cause and had to be replaced.

The decision was taken to replace it with new foundation in 2021. The duration of the project was estimated at 18 months with the international context linked to the covid situation.

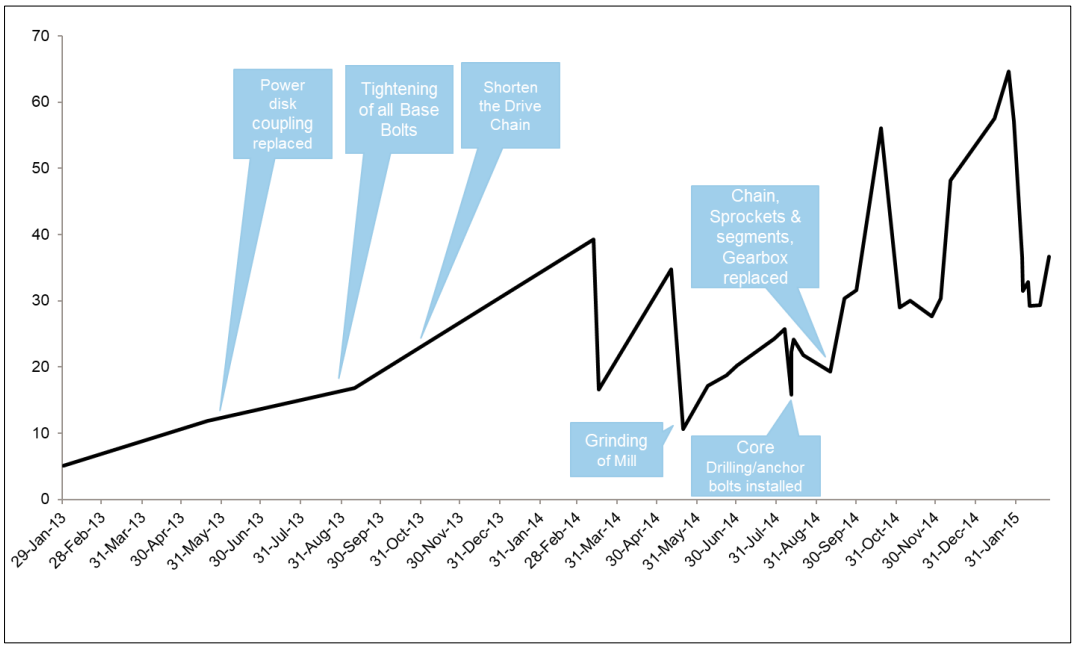

Figure 2. Summary of failures and issues of the AM from January 2013-January 2015.

Figure 8. Blow bar gap and profile after utilization.

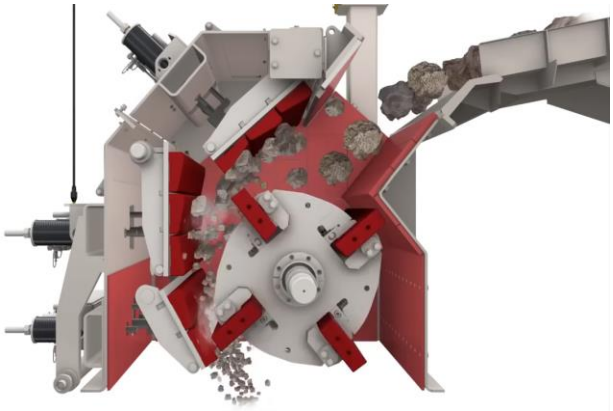

Figure 9. Presence of the four blow bars.

4. Conclusion

The installation commissioning and operation of the impact crusher as an alternative to the autogenous mill were a success. From the point of view of productivity, reliability, cost, outlet product size and type of feeding material, the equipment met all the requirements and the expectations.

It gave enough flexibility to try different setup configuration with the aim of producing coarser material unlike a gravity breaker hole diameter size with a fixed outlet product size maximum.

It successfully permitted the change-out of the AM and provides Sohar Aluminium a permanent, reliable, and resilient contingency to sustain the continuous operation.

5. References

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