Amperage Increase in EGA Al Taweelah Potline 3

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Abstract

EGA's DX+ technology was conceived as high productivity version of DX technology, operating in potlines 1 and 2 in EGA Al Taweelah smelter. After successful demonstration in five DX+ cells in Jebel Ali smelter in 2010, the DX+ technology was selected for Al Taweelah Potline 3, which started up 444 DX+ cells at 440-444 kA from September 2013 to June 2014. Amperage increase started soon after the completion of the start-up and reached 450 kA in September 2014 and 455 kA in March 2015. The following year was very active, bringing the amperage to 460 kA in March and to 465 kA in December 2016, which was already 5 kA above the maximum design amperage. This was enough for the first generation of DX+ cells. The installation of DX+ Ultra cathodes with copper inserts in the collector bars in the second generation of cells finally enabled further amperage increase to 470 kA in March 2020. In April 2021, the amperage was increased to 472 kA. At anode current density of 1 A/cm^2, this is a benchmark of highest metal productivity per utilised plant area and people involved in operation. The potline performance remained excellent through all these years. The metal production increased from 3397 kg/pot-day at the end of potline start-up in June 2014 to 3554 kg/pot-day in full year 2021. The yearly average current efficiency has been between 94.0 and 94.6 % the gross specific energy consumption between 13.2 and 13.5 kWh/kg Al and the net carbon consumption between 412 and 417 kg C/t Al. The second generation of cells with DX+ Ultra cathodes improved the performance to 94.6 % current efficiency and lowered gross specific energy consumption to 13.2 kWh/kg Al. Premium metal purity with very low iron has been produced throughout the years. This paper will describe the potline performance and challenges and strategy of amperage increase as well as the turnover from the first to the second generation of the cathodes.

Keywords: DX+ technology, Amperage increase, Cell performance, Cell relining, Potlife.

1. Introduction

EGA Al Taweelah Potline 3 (444 pots) with DX+ technology was started at 440 -440 kA [1] and increased amperage to a maximum of 470 kA in different stages. Potline parameters were adjusted at different amperages to maintain pot stability and heat balance. Some cathode design modifications, including the use of collector bar copper inserts, were also made. The first pot replacement started from the end of 2017 was completed by 2020 at the rate of approximately 4

pots per week, achieving potlife of more than 1800 days for the first generation. The pot replacement allowed for further amperage increase.

In 2021, Al Taweelah potlines were extended by 66 pots, of which 14 DX+ Ultra pots were in Potline 3 [2]. This increased nominal Potline 3 annual production at 465 kA and 94.2 % current efficiency, by approximately 18 000 tonnes per year for a total production of approximately 572 000 tonnes per year.

2. Summary of Amperage Increase Milestones

From the start-up initially at 440 kA, Potline 3 amperage increase to 472 kA proceeded in several stages.

- The first stage was increasing amperage from 440 kA to 450 kA which was completed in the first year of operation.
- The second stage was from 450 kA to 455 kA in 2015.
- The third stage was from 455 kA to 462 kA on 2016.
- The fourth stage was from 462 kA to 465 kA in 2017, where it stayed for three years.
- The fifth stage was mainly after replacing approximately 90 % of generation 1 cathodes by generation 2 cathodes; in this stage, amperage was increased to 470 kA in April 2020 until June 2021.
- Thereafter, the amperage was decreased to 465 kA, while waiting for an additional rectifier, anode length increase to lower the anode current density, and generation 3 cathode design.

Figure 1 shows the different stages of amperage increase from the start-up to June of 2022.

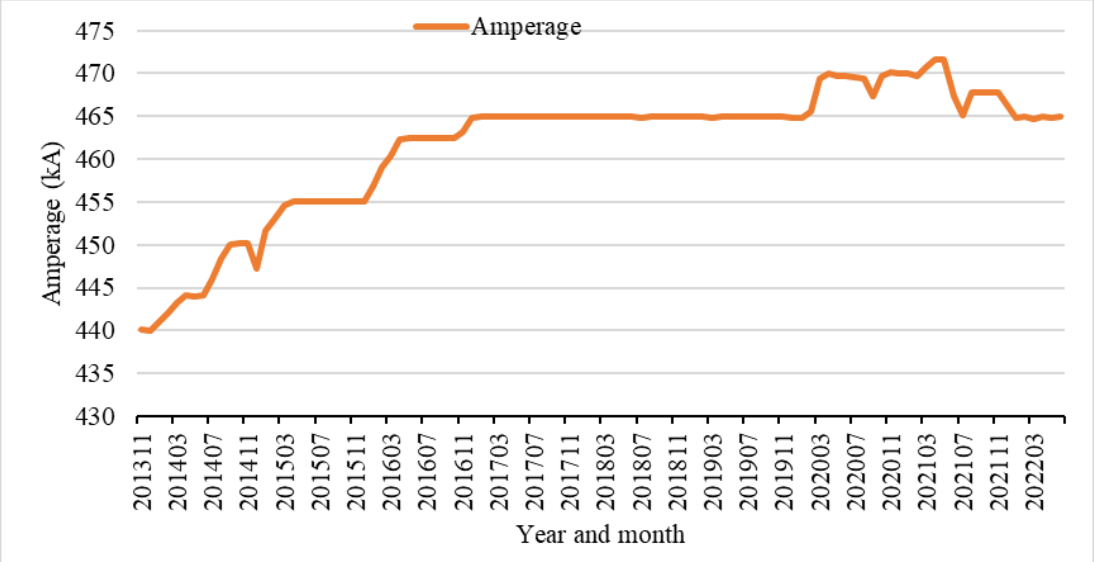

Figure 1. Amperage evolution from November 2013 to June 2022.

3. Major Changes during Amperage Increase

The enablers for amperage increase from 440 kA to 470 kA were design changes and adjustment of pot operation parameters to maintain pot stability and heat balance.

7. References

1. Michel Reverdy et al., The successful implementation of DUBAL DX+ technology at EMAL, *Light Metals* 2016, 307-311.
2. Abdallah Abdelrahman Rahbar et al., Potlines extension project in EGA Al Taweelah smelter, *Proceedings of 40th International ICSOBA Conference, Athens, Greece, 10-14 October 2022*, Paper AL03, *Travaux* 51.
3. W. E. Haupin, Interpreting the components of cell voltage, *Light Metals* 1998, 531-537.
4. Ali Zarouni et al., DX+, An optimized version of DX Technology, *Light Metals* 2012, 697-702.
5. Nadia Ahli et al., Amperage increase in DX+ Ultra demonstration cells at EGA's Jebel Ali smelter, *Proceedings of the 39th International ICSOBA Conference*, Virtual, 22 - 24 November 2021, *Travaux* 50, 637-646.
6. Sajid Hussain et al., ALBA Potline 6 operation during amperage increase, *Proceedings of the 40th International ICSOBA Conference*, Athens, Greece, 10-14 October 2022, *Travaux* 51, Paper AL02.
7. https://international-aluminium.org/statistics/fluoride-emissions/ (accessed on 18 August 2022).