

The Challenge to Replace the First Generation Pots Following a Rapid Successful Startup of a Large Number of Pots

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Abstract

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Pot reconstruction on mature potlines is usually a relatively straight forward affair with a typical smelter having a range of from 240 to 750 pots. With an average life of approximately 5 years the average cut out rate is therefore 1 to 3 pots per week, with an occasional peak of say 4 to 5 pots per week. When starting new potlines, faster start-up rates are usually recorded as the pots are built in situ and therefore typically rate limited by availability of cut-in equipment and bath production and project construction progress. However how does one of the world's newest and largest smelters go about replacing 756 pots that were all successfully started over a 13 month period with no failures? This paper describes how Emirates Global Aluminium's (EGA) Al Taweelah smelter used human and plant resources to successfully and safely replace approximately 90 % of 756 pots in 24 months, peaking at 10 pots per week and included a major upgrade of the potshells during the pot turn around.

Keywords: DX Technology; cell lining, cell reconstruction.

1. Introduction

Emirates Global Aluminium's Al Taweelah smelter was built in two construction phases, the first being the startup of 756 pots using EGA's own DX Pot Technology over a 13 month period from 2009 to 2011 [1]. The second being the start-up of 444 pots using EGA's own DX+ Technology over a 9 month period from September 2013 to June 2014 [2]. This paper will focus on the replacement of the first generation pots from Phase 1, which is also the first industrialised installation of the DX Pot Technology.

The DX Technology for Al Taweelah Phase 1 was selected based on the successful performance of the 40 pot demonstration potline at EGA's Jebel Ali smelter, which was commissioned during 2008, which was itself built on the successful five demonstration pots in the Eagle section at Jebel Ali smelter.

The first DX pot was started on 2nd December 2009 and the last 756th pot on the 2nd January 2011 at an average of 1.9 pots per day, peaking at 6 pots per day (Figure 1). The start-up was very successful as not one pot failed or was required to be restarted. Adding to the highly successful start-up was that not one pot subsequently failed over the following approximately 4 years.

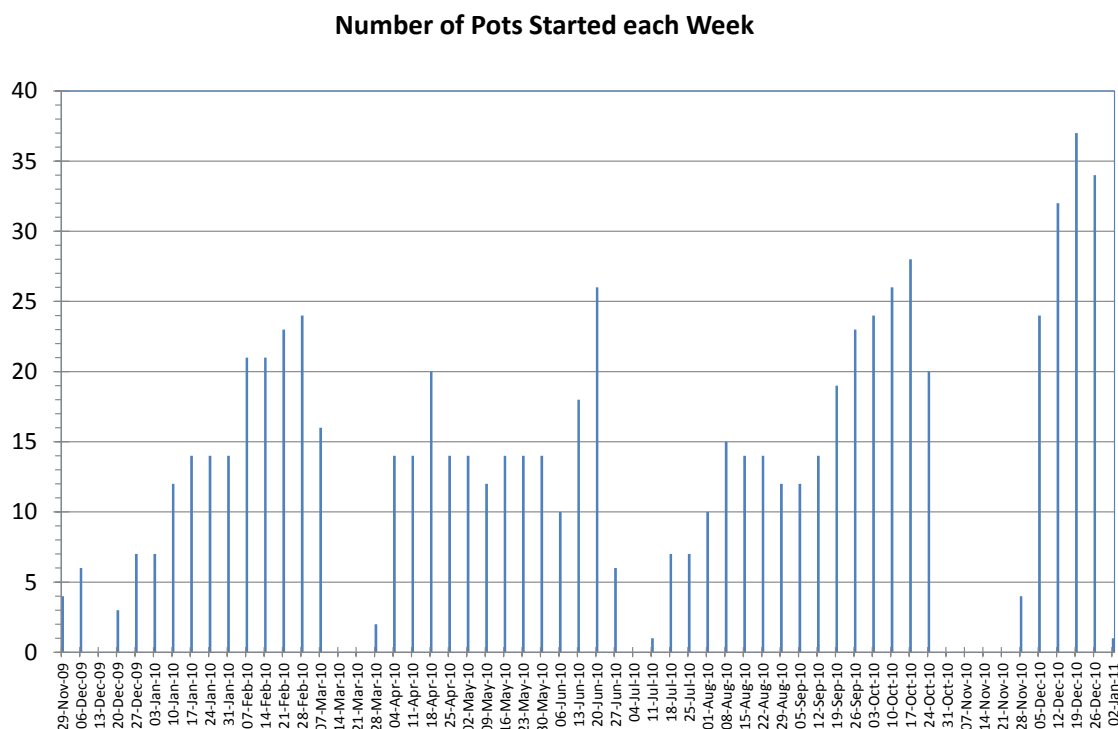


Figure 1. AT Taweelah Phase 1, number of pots started each week.

As the two DX potlines at Al Taweelah were the first commercialised potlines of EGA's DX Technology and with the pot age of the demonstration potline still to reach end of life, the predicted age of failure for the technology was initially based on the Eagle pot autopsies undertaken on the five eagle pots which were shutdown at mid-life in January 2010, at ages from 1346 to 1432 days, to give place to five DX+ demonstration pots. With the potential for some differences in potlife due to higher operating amperage and design enhancement from the Eagle pots, EGA decided to selectively remove the first pot 2B002 at the age of 1560 days at then 380 kA, which was curtailed to enable a detailed autopsy. The purpose of the autopsy was to enable a snapshot of how the cathodes are aging and the performance of the lining in general.

2. The Problems with Successful large Scale First Generation Start-up

As demonstrated in Figure 2, a successful theoretical pot start-up with standard deviation of say 150 - 250 days in pot age would over time have declining and widening peaks in subsequent generations of pots due to randomization of pot age amongst the population. Thus the first generation pot replacement would require more resources to enable pots to be replaced without loss of pots in circuit days.

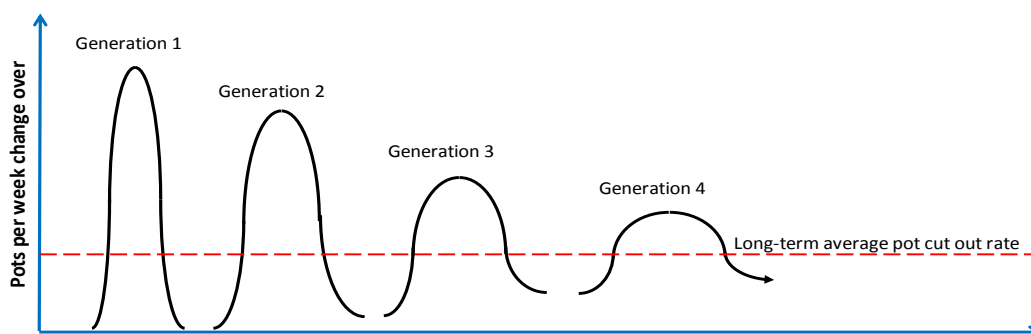


Figure 2. Theoretical pot generational replacement rate following successful start-up.

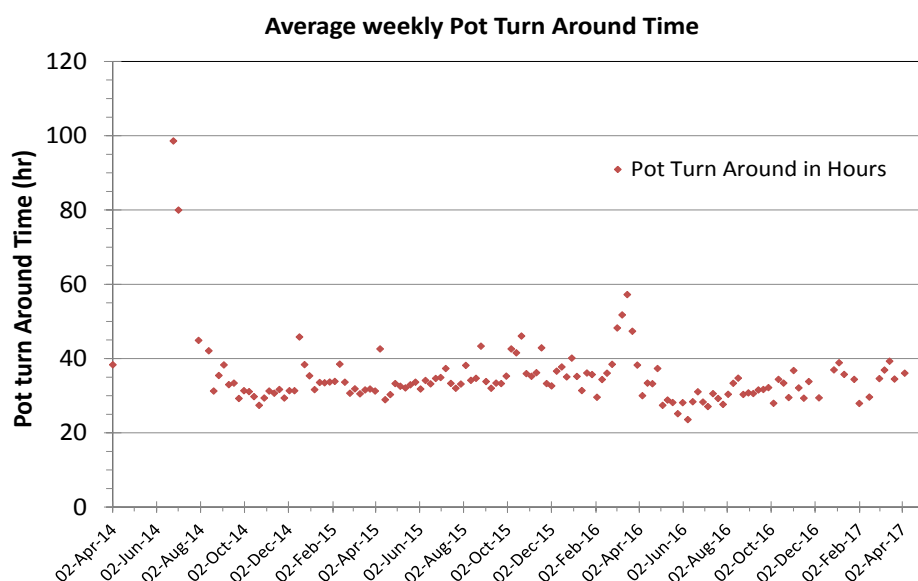


Figure 8. Average weekly pot turn around.

8. Summary of Pot Failure Statistics

- A total of 125 pots were selectively culled, most of which in Line 2 to prevent the pot failures exceeding the capacity of the deline facility.
- Seven pots tapped out, less than 1 % of the total population, with an average age of 1947 days.
- The oldest pots failed at 2342 days, failing in May 2017, 5 months beyond predicted.
- Seven pots were removed due to high cumulative silicon loss.
- No pots were removed due to mechanical or other issues from operations, superstructures, power outages, etc.

9. Conclusion

The overall average pot cut-out rate achieved was 5.1 pots per week with a peak of 14 pots. The average weekly pot turnaround time was 35 h/pot which included training and commissioning of the entire delining and pot handling equipment.

EGA Al Taweelah was able to demonstrate that not only was it able to undertake one of the industry's most successful single phase pot line start-ups with all 756 pots successfully started in 13 months, these pots continued to operate for a further 4 years without any failures. Additionally EGA Al Taweelah was able to take this level of success to the next level by replacing all 756 pots over a 35 month period with minimal loss of pot availability, with less than 1 % of the population tapping out and minimal number of healthy pots prematurely culled.

10. References

1. B.K. Kakkar et al, Commissioning of emirates aluminium smelter potlines, *Light Metals* 2012, 721-726.
2. Walid Al Sayed et al., World's longest potline start-up at EMAL, *Light Metals* 2015, 505-510.