Scaling Potline Amperage Due to Rectifier Maintenance in DX Technology Line 8

Satheesh Mani[1], Praveen Gupta[2], Handerson Dias[3], Shaikha Al Shehhi[4] and Yusuf Ahli[5]
1. Lead Engineer – Process Control
2. Superintendent Test Pots & Projects
3. Senior Manager – Potlines Reduction
4. Senior Manager – Process Control
5. Vice President – Reduction
. Emirates Global Aluminium, Dubai, UAE
Corresponding author: pgupta@ega.ae
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Abstract

Emirates Global Aluminium (EGA) proprietary DX technology in Jebel Ali Line 8 has seen continuous amperage increase from 340 kA at start-up in 2008 to 440 kA today. Line 8 of 44 cells is at the end of Line 6 operating at 260 kA, therefore, at 440 kA, 180 kA has to be supplied by four Line 8 booster rectifiers, 45 kA per rectifier, at nameplate capacity. The booster rectifier station was designed in N-1 configuration with four rectifiers, three in operation and the fourth one on standby for maintenance, to keep line current constant. However, with large amperage increase from 340 kA to 440 kA since the start-up in 2008, when the amperage reached 400 kA 1n 2014, all four booster rectifiers have been used in routine operation. Consequently, during annual maintenance, taking 7 days per rectifier, and 28 days for four rectifiers, the potline operated at 35 to 45 kA below the normal amperage with the three booster rectifiers. This required changes in many cell operation and cell control parameters.

This paper describes the strategies and practices for rapid amperage decrease by 35-45 kA at the start of maintenance, and rapid increase to normal amperage at the end of maintenance. Now, the amperage is decreased in increase at the end of maintenance has been shortened from fourteen days to just two days in 2-3 steps, thus restoring normal metal output rapidly.

Keywords: Aluminium electrolysis potline, Rectifier maintenance, N-1 rectifier operation, Potline operation at reduced amperage.

1. Introduction

Emirates Global Aluminium (EGA) operates its proprietary DX technology in Jebel Ali Potline 8 (PL8) and Al Taweelah Potlines 1 and 2. PL 8 is operating at 440 kA today, after continuous amperage increase from its humble beginning at 340 kA. The amperage increase required continuous improvement and modifications.

PL8 gets power from two sources: Potline 6 and PL8 booster rectifier transformer (RT). The configuration is given in Table 1:

Table 1. Rectifier configurations for Potline 8.

Potline	Rectifiers	Each rectifier operating current (kA)	Line operating current (kA)
Main Line 6	5+1 (SBRT)	53	260
Booster Line 8	4	45	180
Total Line 8 (Sum)	10		440

The annual RT maintenance schedule involves taking each booster RT offline for one week to do maintenance, and smooth operation in this interval. This maintenance schedule impacts Line 8 set operating current. Line 6 has "N-1" configuration due to the availability of Swing Booster RT (SBRT), ensuring no impact on amperage, when any RT is taken off for maintenance. Line 8 operates in "N" configuration, requiring a de-load of 45 kA in booster line during RT maintenance, impacting the amperage supplied to Line 8. In practice the amperage reduction was less than 45 kA because some more than usual amperage was supplied by the remaining three rectifiers.

Historically, the duration of amperage reduction and ramp-up was high. In this project, the objective was to reduce the metal loss during this transition period without compromising the cell performance. The result is shown In Table 2.

Table 2. Amperage reduction and amperage increase time for rectifier maintenance.

Amperage reduction	Amperage lowering time (days)	Amperage raising time (days)
Up to and including 2020	10	18
In and after 2021	2	2
Net gain	8	16

This paper presents the impact of 35 to 45 kA amperage reduction for RT maintenance and increase at the end of RT maintenance in PL8, and how the reduction team achieved the lower transition period.

1.1 Baseline Performance (Historical Background)

During RT maintenance, potline amperage is reduced by 35 kA and it leads to approximately 50-60 kW lower internal heat. This is partially compensated by increasing the ACD and by reducing the heat loss.

Two main challenges during this process are:

1. Maintain target bath height - While increasing ACD the cell demands considerable amount of liquid bath, which has to be tapped at the end of maintenance when restoring the normal ACD.
2. Maintain thermal balance - Operation practice and key parameter to be changed to minimise the heat loss.

1.2 Earlier Approach for RT Maintenance (Before and in 2020):

Prior to 2021, the amperage reduction and increase were done at a slow rate as shown in Figure-1. This typically took 10 to 20 days to reduce, and 10 to 20 days to increase the amperage during RT maintenance (Figure 1). This includes:

- Lowering amperage in small steps by 3 kA/day and raising it at 1–2 kA/day.
- The adjustment of Base Resistance Set Point (BRSP) in steps to manage liquid bath adjustment, required because of ACD increase at the start, and ACD decrease at the end of maintenance. This also impacts the heat balance.

Heat balance was calculated in terms of internal heat (Q_{in}) as in [2]. Internal heat is net heat in the cell, which is the difference between generated heat and absorbed heat by chemical reactions and auxiliary processes. In thermal balance, the internal heat is equal to heat loss. The distribution of the heat loss from the cell surfaces is calculated using mathematical models [3]. Figure 3 shows potline amperage and BRSP. Table 3 gives the average data for the period of 30 days before the

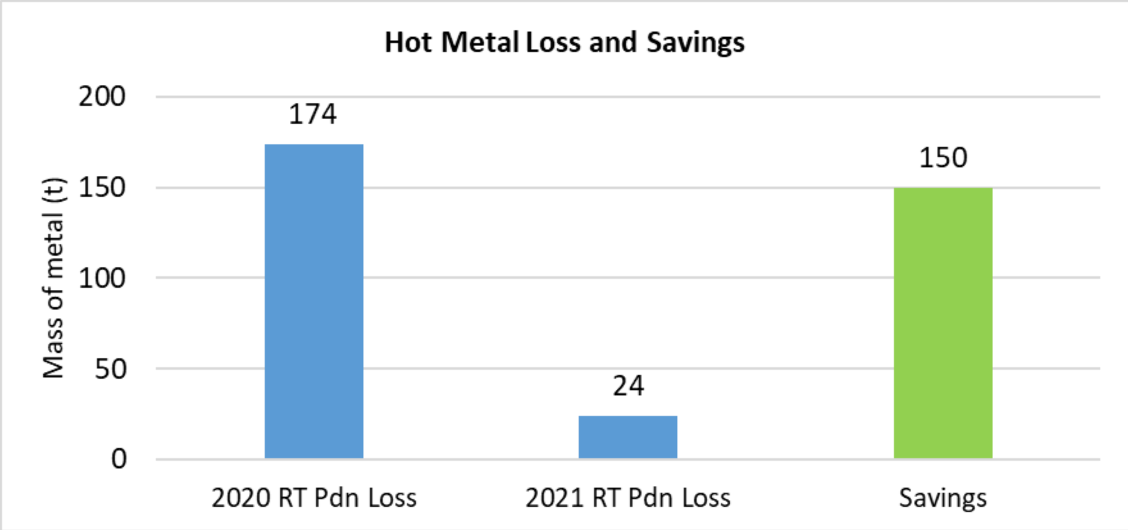

Figure 5. Production loss comparison before and after the project. Pdn = Production.

4. Conclusions

The work practice developed has resulted in a significant time reduction of de-loading and loading of the amperage during the rectifier maintenance. The practice now decreases the amperage in 48 hours instead of 10 days, and increases it back to normal operating target in 48 hours instead of 18 days previously. This reduced the metal loss by 150 t during the rectifier maintenance.

The two examples analysed in this paper show that the operation at internal heat much below the normal is not easy, particularly with rapid amperage reduction and restoration which can cause bath temperature and excess AlF_3 swings. This gave us the indication that better predictive actions, in use now, are required.

5. References

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