

## Managing Pot Operation of 340 kA Prebake Potline at Reduced Amperage of 280 kA

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### Abstract

It is extremely challenging when a Potline is to be operated on lower amperage than the design capacity for an extended period of time. One such case occurred on 12<sup>th</sup> April, 2017 in Vedanta Limited at Jharsuguda Smelter. Out of six rectifiers (N+1 configuration) to supply current to Potline 4, two developed serious fault and the current was dropped to 280 kA from 340 kA. It was told that it might take more than four weeks to get the fifth rectifier in service. To run the line at 280 kA for over four weeks was a huge challenge. Emergency meeting was held and a strategy was formed to manage the operation at 280 kA. Pot voltage was raised by 200 mV. Some of the actions, immediately enforced, were: tap metal, suspend anode changing activity and ask the other lines to supply liquid bath. About 1000 tons of metal was tapped in 24 hours and more than 100 tones liquid bath was generated. All these measures have given us confidence that we were on the right track. Potline 4 was running at reduced amperage in a healthy way until it was ramped back up to 340 kA smoothly.

**Keywords:** Operating potline at reduced amperage; Vedanta Jharsuguda; cell energy balance; liquid bath generation.

### 1. Introduction

Vedanta is the largest Aluminium producer in India with a capacity of 2.3 million ton per annum and a 48 % market share in India's Aluminium industry. Vedanta Limited is renowned for its superior metallurgical alumina and high quality aluminium products and operates a world class international standard smelter in Jharsuguda, Odisha and BALCO - Korba, Chhattisgarh. Potlines are run with GP 320 GAMI Cell Technology from China. Vedanta Ltd, Aluminium & Power, Jharsuguda has set up a greenfield aluminium smelter in Odisha with a capacity of 1.75 Mtpa (0.5 Mtpa + 1.25 Mtpa) and 3615 MW Power Plant, one of the single location largest smelter in the world. The company has built high quality modern infrastructure at Jharsuguda with full-fledged township having all the modern amenities for the staff. At Vedanta Limited, we are committed to providing our employees with a supportive, rewarding and safe work environment with a high degree of engagement and empowerment, enabling them to realize their full potential.

Vedanta Limited, Jharsuguda has 2 smelters consisting six potlines. Smelter 1 consists of two potlines and each potline is supported by a rectifier station with a facility of 5 rectifier transformers of 85 kA capacity each. Also, a separate carbon plant to supply anodes and independent cast house to take metal from both potlines. Smelter 2 potlines are supported by a rectifier station with a facility of 6 rectifier transformers of 76 kA capacity each. All six are in

operation except the PM, these are based on n-1 configuration and five rectifiers are always in operation. Like Smelter 1, Smelter 2 also has a separate carbon plant and also separate cast house. The potlines in Smelter 1 were commissioned in 2008 with the design current of 325 kA. Potlines in Smelter 2 were started in Sep 2014 with design current of 340 kA. In Smelter 2, two lines are fully commissioned and the other two are under commissioning. With continuous process improvements, operational excellence along with technical innovations, the amperage in Smelter 1 Potline has been increased up to 328 kA. Smelter 2 amperage has been increased as well up to 343 kA.

## **2. Rectifier Incident :**

On 12 April 2017, Pot line 4 which was operating at 340 kA had a failure of potential transformer. Because of this, two rectifier units had to be taken off and we were left with only four rectifiers, bringing down the amperage to 280 kA from 340 kA. Unfortunately there was no provision to get the supply from other rectifiers of other lines. We did not have any alternative except to manage the line at 280 kA for indefinite period. Running the line at lower amperage was a huge challenge. The biggest issue was to find an equilibrium of thermal balance, running the line cold which could be disastrous for the line and it was very likely that the line could be shut down if the corrective action was delayed.

## **3. Impact of the Reduced Load & Corrective Actions Taken to Maintain Potline at 280 kA**

The Potline in smelter 2 Vedanta has been designed to run at 340 kA and all parameters like liquid levels, bath temperatures, noise etc. were optimized to operate the line smoothly. But due to unforeseen breakdown in line 4 rectifier unit amperage came down to 280 kA. This had a large impact on the parameters of prebaked cell and we faced a dozen of obstacles. The main challenge was to maintain heat balance at reduced load and keep all pots running. Next 24 hrs. were very crucial & critical as line can go either way if urgent actions are not taken immediately. This aim needed utmost care, complete focus and greater co-operation from all the teams. So immediately after the failure of rectifier, emergency control room was set up, brainstorming sessions were conducted to make the strategy to handle the situation. Finally the team came up with an emergency action plan and developed guidelines for operating a Potline at reduced load. Same incident was experienced year back in the smelter 1 which also helped a lot to set up the SOP and control parameters even faster than previous incident. Primarily team focused on maintaining the heat balance which was badly disrupted due to sudden power reduction.

## **4. The Following Actions Were Taken to Manage the Impact of 280KA and Save the Line.**

- 4.1.** The maintenance of high bath temperature was the primary step taken to maintain heat balance in the pot. For doing that the set voltage of pots were increased from 4.18 V to 4.5 V. The ratio between the metal height and bath height was disturbed leading to a greater metal height in comparison to the bath height. Extra tapping was planned to hold the temperature in the pot constant by reducing the metal height from 27 cm to 24 cm, but without resources and immediate extra metal handling capacity in cast house it was not possible to execute it. It was one of the most challenging jobs to take the extra metal out in order to maintain heat balance in the pots. As a way out we have decided to skip one cycle tapping in Potline 3 which was running with normal amperage and moved all resources to Potline 4. For fast tapping we have taken help of Hencon (tapping vehicle) from Smelter 1. It helped us evacuate the metal with speed from Line 4 without much overloading the cast house. Proper planning resulted in evacuation of approximately 1050 Mt extra metal from pot, i.e., 550 t in 24 h and another 500 t in 48 h.
- 4.2.** To speed up the tapping sections, the floor must be free from all other activities like anode change so we decided to skip 4 anode change cycles immediately to speed up the metal tapping and beam raising activity.

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