# Commissioning and Start-up of Alba Line 6 Project Using EGA DX+ Ultra Technology

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**Abstract**

"Success is where Preparation and Opportunity meet". This was a founding principle for the Aluminium Bahrain (Alba) team as it prepared and completed the commissioning and start-up of Alba Line 6 Smelter Project, which became the world's largest single site aluminium smelter outside China. From First Hot Metal achieved after a 24 months construction period (six months faster than industry standard) to Last Hot Metal, the commissioning and start-up of Line 6 Project required innovative ways to manage the interfaces between construction, the various equipment vendors and the operating plant in start-up. This paper presents the comprehensive start-up preparation framework employed by Alba, along with the coordination of the start-up of the DX+ Ultra Technology potline that allowed seizing each opportunity to maximize aluminium production.

**Keywords:** Aluminium smelter start-up preparation, change management, smelter commissioning and start-up, smelter operations readiness, workarounds, resilience.

## 1. Alba Line 6 Project

Aluminium Bahrain B.S.C. (Alba), one of the largest and modern aluminium smelters in the world, was established in 1971 as a 120 000 tonnes per annum smelter. With three successive expansions, the smelter capacity has grown to more than 1 million tonnes in 2018. Alba's Line 6 Expansion Project is one of the largest brownfield developments in the region. It will boost the smelter's per-annum production by 540 000 tonnes, bringing its total production capacity to 1.5 million tonnes per year in 2020.

With a CAPEX of approximately 3 billion US$ , the Line 6 Expansion Project involves the construction of a new 1.4 kilometers long potline utilizing Emirates Global Aluminium's (EGA) proprietary DX+ Ultra Technology, a new Carbon plant, a new Casthouse, a 1 800 MW Power Station and other industrial services. The Line 6 Expansion Project makes Alba the world's largest single-site aluminium smelter outside of China and a significant economic boost for the Kingdom of Bahrain.

In June 2015, Alba Board approved the Line 6 Expansion Project. Bechtel was appointed as the engineering, procurement and construction management (EPCM) contractor in 2016 and work on the Front-End Engineering Design (FEED) study was initiated. The project Notice to Proceed (NTP) was received in January 2017. A number of Lump Sum Turn Key (LSTK) contracts were awarded early in the project to support the fast pace project schedule.

The construction site-works started in the second quarter of 2017. First Hot Metal (FHM) was successfully achieved on 13 December 2018, 24 months from NTP – six months faster than industry standard. Last Hot Metal was achieved on 31 July 2019, 31 months from NTP, making it the fastest aluminium smelter project in the GCC. This was accomplished with exemplary safety statistics making it also the safest start-up.

### 1.1. EGA DX+ Ultra Technology

The DX+ Ultra technology is an advancement of the DX+ Technology successfully implemented at EGA Al Taweelah Potline 3. In 2014, five DX+ Ultra demonstration cells were built and commissioned at EGA Jebel Ali. The DX+ Ultra cells have the same dimensions as the DX+ cells but incorporate amongst key changes, new cathode design, decreased cell-to-cell centerline and modified busbar thus savings on CAPEX and OPEX. The end-result is a best-in-class production per building surface area [1, 2].

Alba Potline 6 consists of 424 reduction cells arranged in two potroom buildings connected by one central passageway at the mid-point of the potrooms and a passageway at the north and the south end of the potlines. The central passage is equipped with a gantry crane for the transfer of the Pot Tending Machines (PTMs) between potrooms, the PTM maintenance shop, and the lining/ de-lining facility. The PTMs are supplied by Fives/ECL under LSTK contract. Two Gas Treatment Centers (GTC for north and south) and associated alumina and anode cover material handling systems were provided by Fives/Solios also under LSTK contract. Key target performance parameters for the DX+ Ultra in potline 6 are given in Table 1.

**Table 1. DX+ Ultra target key performance parameters for ALBA Potline 6.**

| Parameter | Units | Value |
|---|---|---|
| Line current | kA | 460 |
| Current efficiency | % | 94.5 |
| Metal production | kg/pot-day | 3501 |
| Net cell voltage* | V | 4.07 |
| DC net specific energy consumption* | kWh/kg Al | 12.83 |
| Net carbon consumption | kg C/t Al | 410 |

*Net voltage and net specific energy exclude contribution of busbar linkages.

### 1.2. Carbon Plant

The carbon plant (Carbon 4) is composed of a 55 t/h anode paste plant using the Fives/Solios Rhodax technology. The paste plant was delivered under LSTK approach. It shares some installations with the paste plant built for the Line 5 expansion. The Xolios vacuum anode forming mould was sized for the anode dimensions required for potline operations at 460 kA.

The anode baking furnace (ABF) is a Riedhammer open top baking furnace with 8 pits per sections, 68 sections and four production fires designed to operate at 26 h fire cycle. The ABF was supplied under LSTK approach by Riedhammer, including the ABF ancillaries (furnace cranes NKM), fume treatment centre (Danieli) and firing ramps (Innovatherm).

The anode rodding shop (ARS) supplied by Outotec includes a casting station with 3 induction furnaces. The cold loop is designed to process cold butts and includes bath recycling plant using rotary breaker technology. The carbon recycling section is linked to the existing plant. The rodding shop was supplied under LSTK approach.

### 1.3. Casthouse

The casthouse (Casthouse 4), is composed of a 10 kg standard ingot chain (Befesa) for value added product (VAP), a sheet ingot vertical direct chill (VDC) facility producing slabs and tee ingots and a billet VDC producing various diameters and alloys (both VDC are from Wagstaff). The billet casting complex includes continuous and batch


**Figure 6. Line 6 safe start-up LHM celebration.**

## 8. References

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