Increase Casting Capacity of DC-5 Caster at EGA Jebel Ali

Afshin Lutfi[1], Yaqoub Youssef Ahmad[2], Omar Al Hashmi[3], Farukh Azim[4], Nilay Shah[5] and Abani Kumar Meher[6]
1. Senior Superintendent - Cast House Maintenance 2,
3. Supervisor - Cast House Maintenance
4, 5. Senior Technician - Cast House Maintenance
6. Senior Engineer – Lean Manufacturing
Emirates Global Aluminium (EGA), Jebel Ali, United Arab Emirates
Corresponding author: alutfi@ega.ae
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Abstract

At EGA Jebel Ali site, the Direct Chilled (DC) casting complex "DC-5 caster" was installed at Casthouse 2 in 2003. The billet casting equipment was supplied by Wagstaff, and has a production capacity of 60 t per cast. Aligned with EGA's core values of continuous improvement, management aims to enhance productivity and manufacturing capacity by exploring opportunities to increase productivity and casting capacity. Each cast involves significant consumption of consumables and demands considerable preparation time and effort from operators. The goal was to boost productivity per cast from 60 t to 70 t, and reduce operational consumables.

Keywords: Productivity increase, Optimise operational consumables, Increase metal production per cast, Cost saving, Reduce scrap generation.

1. Introduction

EGA Jebal Ali Casthouse 2's direct chilled caster (air-slip DC casting), with a casting capacity of 60 t per cast and 12 casts per day, plays key role in organisations aluminium billet production. Air-slip casting technology produces the highest quality billets, known for their smooth surface finish, small shell zone, and uniform-grain structure.. The air-slip process uses an optimised mould length, faster casting speed, individual water jets and a unique air cushion to minimise heat extraction through the mould and enhance secondary cooling. The direct chill (DC) casting process extracts heat through two mechanisms: first through the mould wall as the molten metal contacts it, and secondly through direct contact (or "direct chill") with a specifically designed water pattern as the semi-solidified billet exits the mould.

1.1 DC Caster Operation

Air-slip casting / DC casting process requires various raw materials and consumables with synchronised system parameters to achieve a high quality product. This process involves pouring molten aluminium into a water-cooled mould. As the aluminium cools and solidifies, a large cylindrical ingot, known as a billet, is formed. The DC casting table is shown in Figure 1.

Figure 1. Air-slip casting table with mould and billets.

Here is a general overview of the process:

1. **Melting**: Aluminium scrap or primary aluminium is melted in a furnace to form molten aluminium.
2. **Degassing and alloying**: The molten aluminium is treated to remove any impurities and gases, and alloying elements may be added to achieve the desired material properties.
3. **Casting**: The molten aluminium is then poured into a water-cooled mould. As the aluminium flows into the mould, it rapidly solidifies from the bottom up due to the cooling effect of the water-cooled surface. This process, known as Air-Slip Direct Chill (DC) casting, produces a solid cylindrical ingot called a billet. This rapid cooling helps to produce a fine-grained structure with desirable mechanical properties.
4. **Billet Removal**: Once the aluminium has solidified, the mould is opened, and the billet is removed. The billet is typically hot, so it may be allowed to cool slightly before further processing.
5. **Homogenisation**: After casting, the billet undergoes a homogenisation process to ensure uniformity in composition and microstructure. This involves heating the billet to a specific temperature for a certain duration, followed by controlled cooling.
6. **Sawing**: The billet is then cut into shorter lengths using saws. This step prepares the billets for subsequent processes such as extrusion or rolling.
7. **Quality Control**: Throughout the process, quality control measures are implemented to ensure the billets meet specified standards for dimensions, surface finish, and material properties.
8. **Further Processing**: The billets are further processed through extrusion, rolling, or other forming techniques to produce final products such as profiles, bars, rods, or sheets.

Aluminium billets generated via DC casting find extensive applications across diverse industries such as automotive, aerospace, construction, and consumer goods. Their popularity stems from their exceptional strength-to-weight ratio, resistance to corrosion, and recyclability.

1.2 DC Caster Maintenance

Some of the major components of DC Casters are:

1. **Hydraulic power unit** (Figure 2) – The hydraulic power unit serves as the fluid power source and oversees the operation of both the casting cylinder and mould table tilt system.