# Process Efficiency Improvement of Billet Saw and Digitalisation of Ingot Caster at EGA

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https://doi.org/10.71659/icsoba2025-ch010

**Abstract**

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The billet and ingot binding process, followed by the saw cutting complex and ingot stacking through robots at the EGA Cast House, plays a critical role in ensuring a seamless flow of production and customer requirements. This paper explores the identification of various types of process wastages, inefficiencies, and non-value-added activities in Billet Saw Complex. The amalgamation of this exploration will facilitate the seamless cutting of billets with a minimum 2000 mm cut length with an increase in process capability by approximately 25 % to 40 %.

Alongside, a new smart Missing Piece Detection System (MPDS) was introduced in ingot caster at EGA. The MPDS leverages digitalisation, advanced technologies, including smart sensors, sensor networks and pattern recognition. The integration of these technologies enables the real-time detection of missing ingots, thereby improving operational effectiveness and minimizing disruptions in the production process to enhance overall process efficiency.

The paper focuses on process optimisation, identification of various process wastages, system's architecture, anomaly detection algorithms, user interface and utilisation of advanced technologies aligning production demands to improve workflow efficiency by eliminating process depletion and adopting new digital smart system which support Industry 4.0 as well.

**Keywords:** Elimination of process wastage, Digitalisation and smart sensors, Process efficiency improvement, Reduced cycle time and rework, Flexibility in production planning.

## 1. Introduction

### 1.1 Billet Saw Complex at EGA Cast House

An aluminium billet saw is designed to cut long aluminium billets into shorter, precisely sized sections for downstream processes like extrusion, forging, or rolling. These saws are optimised for high precision, efficiency, and minimal material waste.

Functions of an aluminium billet saw complex include:

a) Billet loading
b) Positioning and clamping
c) Cutting to length
d) Cut length control
e) Chip removal and cooling
f) Billet discharge and handling
g) Safety and control.

### 1.2 Ingot Caster at EGA Cast House

The aluminium ingot casting process involves converting molten aluminium into solid ingots typically in various forms such as sows, T-bars, or smaller remelt ingots. The goal is to create a manageable, transportable, and re-meltable product for further processing.

Functions of an aluminium ingot casting system include:

h) Receiving and Filtering Molten Aluminium
i) Mould Filling (Casting)
j) Ingot Formation & Solidification
k) Ingot Removal
l) Weighing, Marking & Stacking
m) Cooling and Storage

## 2. Constraints and Transformational Opportunities for Billet Saw Complex

### 2.1 Current Limitations and Paths to Optimization for Billet Saw Complex

In Jebel Ali Cast House-2 molten aluminium is cast in billets through direct casters DC-4 and DC-5 and then transferred to continuous homogenizing furnaces Phase-3 and Phase-4. Homogenized billets are transferred to saw complex to prepare finished products as per customer requirements.

After homogenization process from Phase -3 complex, billets move through conveyors and then are transferred to Saw-E and Saw-F complex while in Phase-4 billets are moved to Saw-G and Saw-H complex for cutting of billets as per customer requirements. In Cast House-2, long billet cut length requirement varies from 2000 mm to 7500 mm.

In present condition, only two billet saws named Saw G and Saw H, following continuous homogenizing Phase 4 complex, are equipped to cut minimum 2000 mm length while billet Saw E and Saw F following continuous homogenizing Phase-3 complex are equipped to cut minimum 2200 mm length.

### 2.2 Improvement to Optimize the Overall Process Capability

Value stream is each single process step (value-added and non-value added) required to design, order and provide a specific product from concept to launch, order to delivery, and raw materials to finished product at the place where the customer needs it. Figure 1 shows value stream mapping flow chart.

Following value stream mapping analysis, there are 4 stages which need to be followed to identify various process wastages to work upon:

a. Current state
b. Wast identification
c. Ideal state
d. Future state.