

A Novel Approach to Self-Start Open Stream Casting

By Tata Steel | Category: Implemented Innovations

Safety and productivity is important for sustainable business. Tundish acts as buffer for casting steel continuously. Currently, a crude process of casting start-up with high level of hazards is practised. During opening of strand, there is huge amount of metal spillage resulting in an unsafe environment and production loss. This triggered a response to think for a new way of caster start-up by creating a barrier between liquid metal and man, in order to eliminate hazard and metal loss. The team tried to modify the process using some refractory tubes in place of conventional nozzle powder and asbestos plug to control the metal flow.



The Context

Hazard during casting start-up has high potential of injuring people badly. At present, the only physical barriers that exist between metal and man are safety gears. The addition of powder is a hazard in itself. Operators have to work at a height and in hot conditions. The innovation tried to eliminate this risk and also improve productivity by reducing metal loss due to this crude process. Use of safety gears of highest standards was unable to eliminate the hazard. This needed some engineering solutions towards this problem.

Impact of the Innovation

revenue impact

₹295.5 mn



Overcoming Challenges

Initially, when the starter tubes were used, the tubes were getting choked during the opening of the caster, and it was difficult to get smooth opening of the strands without human intervention. The material of construction of the tubes was replaced from Silica to Carbon based with better conductivity, which stopped the choking tendency. Alumina-Carbon based material with better strength and conductivity was used. After overcoming the above challenge, there was still some chokeage tendency. This was happening as metal was not getting enough Ferro-static head above tube opening. For this metal cap above the tube was developed. This gave extra Ferro-static head due to time gained during melting of plant.



The Innovation

Continuous open stream casting of liquid steel is a very hazardous process. Starting of the casting process results in significant metal loss, and is also very unsafe due to spillage of metal from launder. In the current practice, nozzle powder is used above the casting nozzle, which acts as a barrier between liquid steel in tundish and outside atmosphere. There is loss of metal during stabilization of metal stream, and also first 3 m of the billet is rejected due to inhomogeneous carbon content. Sometimes there was production loss due to billet getting punctured as a result of entrapment of powder. These problems triggered an engineering solution. Trigger for this innovation came from the trivial concept of overflow spout in the bath tub. To facilitate the flow of metal while providing a Ferro-static head, tubes (Starter tube) made of refractory material were used to replicate the concept of the bath tub overflow. Starter tube of varying height was developed, according to the team's needs. Silica based starter tubes were used for the 1st time, but the success rate was 50%. The trial was challenging, as the starter tubes choked, and restarting the strand was

very hazardous. Further it was seen that some metal splinters were entering the nozzles, which was accelerating the choking of the nozzles. To mitigate these problems, Aluminum sheet was used as a cover over the tubes. It was found that the thickness of sheet was not optimum, and it was further optimized. But still chokeage continued. All these results forced the team to think about the material design of the starter tube. It was observed that the shroud (Tube) used to transfer liquid steel from ladle to tundish are used without heating, and runs successfully without choking. Conductivity of a refractory plays an important role in avoiding chokeage. These Shrouds are made of Alumina-Carbon, where carbon is conductive. This triggered the team to think of a new material based on Alumina-Carbon for the starter tubes, in place of siliceous material. Alumina-Carbon based tubes were procured from the vendors based on our specifications. These tubes were used, and the team got success in opening of the strands. Subsequently, operational procedure were revised and implemented at casters.