The EM Control is designed for conventional slab casters that utilize ABB ElectroMagnetic Equipment in the mold.

The EM Control is a closed loop control designed for maintaining the meniscus metal flow speed at a preset value independent of varying Ar amounts, slab width and casting speed, see figure above. The EM Control can also partly compensate for biased flow caused by nozzle clogging.

The importance of maintaining the meniscus speed at the preset value is demonstrated in the figure to the right. If the meniscus speed speed is too low, inclusions and gas bubbles will get stuck at the solidification front instead of being washed away by the steel flow. If, on the other hand, the meniscus speed is too high, the excess turbulence at meniscus will greatly increase the risk of mold powder entrapments.

![EM Control Diagram](image-url)
EM Control for conventional Slab Casting

Calculation of the parameters in the EM Control

The flow speed at meniscus and the “static” wave at the mold narrow side are simulated in a computer program, the EM Tool, see below. This gives then the “formula” for translating the wave height to a speed.

Implementation

The parameters for this formula are then implemented in an PLC that is used for the on-line control in the caster. The PLC controls the currents of the FC Mold so that the metal flow speed at meniscus remains at the preset value. The input to the EM Control is the narrow side wave height difference in the mold achieved from two electromagnetic MLC sensors, of which one can be the normal MLC sensor. EM Control uses these measurements and the casting parameters to give the set point for the current.

EM Tool

The EM Tool is a computer program system with following characteristics:

- 3-D Computer program for calculating the magnetic fields.
- 3-D transient metal flow simulation model incorporating 2 phases, steel and gas(Ar) and the electric potential, the electric field and the Lorenz forces.
- Reynold Stress Turbulence model incorporating a transport equation for anisotrophy of the turbulence caused by the magnetic field.
- A quality prediction model showing a blister and a sliver index.

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