EMBR electromagnetic brake
For thin slab casting

The ABB electromagnetic brake (EMBR) allows steelmakers to achieve steel cleanliness similar to conventional vertical bending casters, improve casting speed and enjoy further cost savings as it extends mold lifetime.

By generating a static magnetic field which reduces meniscus metal flow speed and turbulence, the EMBR provides a whole range of metallurgical improvements including elimination of mold powder entrapments, a more even molten mold powder layer and a meniscus which is flatter, hotter and less turbulent. The preferred choice for many steelmakers, the ABB EMBR is already installed on 40% of thin slab strands worldwide and is an essential part of any thin slab casting operation aiming for higher quality market segments and/or faster throughput.

Reduces mold powder entrapments
Mold powder entrapment constitutes a major source of detrimental non-metallic inclusions in thin slab casting. The lower meniscus flow speed and turbulence achieved using the EMBR can significantly reduce mold powder entrapments. In some cases non-metallic inclusions have been reduced by up to 90% using the EMBR.

Improves coil surface quality
Generally speaking, the higher the casting speed the lower the steel quality, though this does not have to be the case. Using an optimized EMBR levels of quality only normally obtained by casters operating at low speeds and not equipped with an EMBR can now be achieved at significantly higher casting speeds.

Improves productivity
By enabling better quality at higher casting speeds, as mentioned above, EMBR also improves productivity. This is especially important to steel shops with only one thin slab strand feeding a dedicated hot rolling mill.

Reduced meniscus waving/swelling
By braking the steel jets exiting the SEN, meniscus swelling close to the narrow sides of the mold is reduced. The resulting flatter meniscus allows for a more even layer of molten mold powder, improving lubrication and lowering the risk of surface cracks.

Extends mold lifetime
EMBR dramatically reduces mold level fluctuations, which in turn reduces temperature cycling and thermal fatigue on the copper mold plates. As a result many casters are able to extend mold lifetime and some steelmakers have reported doubling their mold lifetime using EMBR.

Increases steel temperature at meniscus
Since the EMBR reduces turbulence in the steel, heat transfer from the middle of the mold to the solidification front is reduced. Additionally, hot steel is not pushed down into the strand but kept higher up in the mold, resulting in a higher steel temperature at the meniscus.

Enables new market entry
Thanks to significant improvements in end-product quality, more profitable markets will be within reach of flat product mini-mills using EMBR, such as the white products sector.
Features

• Static magnetic field controls the flow of liquid steel in the mold.
• Ensures a uniform velocity for the molten steel over the entire cross section of the strand.
• Non-contact electromagnetic stirring technology with long lifespan and almost no maintenance.
• Not sensitive to electromagnetic interference.
• Available for all thin slab caster mold types, both new and retrofits.
• Electromagnetic mold level control such as VUHZ can be used.

Benefits

Reduces mold powder entrapments.
Greatly improves coil surface quality.
Enables steel cleanliness similar to conventional vertical bending casters.
Allows for higher casting speed.

Reduces mold copper wear, especially at higher casting speeds.
Reduces meniscus swelling, giving a more even molten mold power layer.
Increases steel temperature at the meniscus.
Enables entry into higher quality market segments.

How it works

The EMBR employs non-contact electromagnetic stirring technology. Each EMBR consists of two or four part coils, placed at each mold wide side. The part coils are fed with direct current from a thyristor converter. The generated static magnetic field brakes the flow speed of the steel jets from the submerged entry nozzle (SEN) thereby reducing turbulence. The EMBR offers self-adaptive braking force i.e. the higher the metal flow speed and turbulence, the stronger the braking force. Various EMBR configurations are available for all thin slab caster mold types, both new and modernization projects.

Real-time, online control

ABB Ability™ Optimold Control is a new digital solution that closes the loop between electromagnetic stirring and braking devices such as the EMBR, and sensors to provide real-time, automatic, online control of mold fluid flow. Via higher utilization of the electromagnetic device’s capacity and performance, near meniscus conditions can be influenced even more than before, enabling even higher levels of process optimization in continuous casting.