Boosting Productivity and Quality in Slab Casting with ABB’s Electromagnetic Systems
Complete Range of Products for Slab Production

Ladle Furnace Stirrer give:
- Clean steel
- Improved yield of alloys
- Reliable stirring
- Reproducible quality
- Less rejects
- Improved safety (no tuyeres)
- Reduced energy consumption
- Improved productivity

FC Molds for medium/high-speed casting of conventional slabs having individual control of the meniscus and penetration flow:
- Improved surface and internal quality
- Possibilities to increase productivity

EMBR Rulers for thin slab casting:
- Improved surface quality
- Reduced mould copper wear
- Increased casting speed
- Possibility to enter new quality segments

FC MEMS for medium/low-speed casting of conventional slabs:
- Direct control of meniscus flow
- Improved surface quality
- Reduced risk of mid-face crack

Slab SEMS give:
- More isotropic magnetic properties for silicon steels
- Reduced ridging/roping for ferritic stain less steels and silicon steels
- Equiaxed structure with reduced centerline segregation
Reliable Partner with Unique Competence

Long-term commitment in the Steel Industry
Stirrers for slabs since the 1970s
Vast metallurgical know-how
Joint developments with leading steel companies

Market leader with complete program
Stirrers and brakes for every application
Installed on more than 100 slab strands

Innovative and unique products
The FC Mold features outstanding performance for conventional slab casters with independent control of the meniscus flow speed and narrow side penetration.
The EMBR Ruler enables thin slab casters to boost both quality and productivity
FC MEMS for low/medium-speed conventional slab casters
The Strand EMS is placed behind rollers for optimum performance and reliability for silicon steels and ferritic stainless steels

Long life and minimum maintenance
Rectangular hollow copper conductors giving:
- Dry insulation with no wear from water particles or chemicals
- Direct cooling gives low and even insulation temperature
- Rigid windings with conductors molded into a solid block

Local presence worldwide
Global network
Local service

Unique know-how in coil design
Advanced transient 3-D computer simulations of steel and inclusion flow pattern with electro-magnetic fields in customer processes.
Optimized design for maximum performance and minimum power consumption
Improved Process Economy for Conventional Slabs

• A unique feature of the FC Mold with two magnetic fields in the mold (to the right in the above picture) is that it independently optimizes the meniscus flow speed and minimizes the penetration flow. The mold powder entrapments are then almost completely eliminated and excellent flotation of inclusions is simultaneously achieved, resulting in outstanding quality and productivity.

• 90% reduction of reject ratio for ULC deep drawing qualities with FC Mold and increased casting speed up to 30% for certain grades and with the FC Mold at JFE, Japan

• FC Mold with DC Technology compared to AC Technology (stirrers) results in:
  - Much lower electrical power costs
  - Normal mold Cu plate thickness
  - Normal mold Cu plate quality
  - Electromagnetic MLCs can be used
  - No special know-how required

• This example shows the reject ratio versus casting speed, tested by means of ultrasonic inspection. With the FC Mold, it is evident that the casting speed can often be increased.

• The ABB Slab Strand Stirrer is used mainly for ferritic stainless steel and silicon steel for decreasing the ridging and roping as well as centerline segregation and halfway cracks.
Improved Process Economy for Thin Slabs

- A high casting speed leaves to high turbulence in the mold and more mold powder entrapments. Therefore, the EMBR gives considerably better results at higher casting speeds. The result is evaluated via an optical surface inspection system after the last stand (F7) in the hot rolling mill. (Thyssen, Germany, 4th European CC conf, 2002)

- 90 % reduction of surface defects with EMBR due to the almost complete elimination of mold powder entrapments. An optical surface inspection system placed after the last stand in the hot rolling mill shows the upper side of coils. (Nucor Steel, Berkeley, USA, AISE 2001)

- Thin slab casting results in a higher total oxygen level than conventional slab casting. With EMBR this level can be lowered to that of conventional casting. More important is that the bigger and dangerous inclusions (>50 µm) are even more infrequent than for conventional casting. The smaller inclusions have been examined by means of metallographic evaluation and the bigger ones by the slime method. (Handan Iron & Steel, China, AISTech 2005)

<table>
<thead>
<tr>
<th></th>
<th>Total O (ppm)</th>
<th>&lt; 50 µm inclusions (# / mm²)</th>
<th>&gt; 50 µm inclusions (mg / 10 kg steel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thin slab without EMBR</td>
<td>31.9</td>
<td>8.36</td>
<td>4.53</td>
</tr>
<tr>
<td>Thin slab with EMBR</td>
<td>19.2</td>
<td>7.16</td>
<td>1.75</td>
</tr>
<tr>
<td>Conventional slab</td>
<td>18.5</td>
<td>6.55</td>
<td>1.99</td>
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</tbody>
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Improved product quality
New market segments
Increased casting speed
Less rejects

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<table>
<thead>
<tr>
<th>Margin</th>
<th>Cost</th>
<th>X Volume</th>
<th>= Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved product quality</td>
<td>Less rejects</td>
<td>Reduced scarfing and grinding</td>
<td>Reduced mould wear</td>
</tr>
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</table>
In metallurgical processing, the technology for stirring and braking the melt is important to ensure a higher quality and productivity. The resulting benefits in terms of reproducible quality and profitable production have been repeatedly demonstrated, often with pay-back times less than a year. As the leading company in this area, ABB can provide advanced solutions for stirrers and brakes, but can also assist our customers worldwide with service and maintenance. Combined with our metallurgical know-how, this makes ABB an ideal partner in the selection and installing of electromagnetic systems.

ABB is the Complete Supplier of Electromagnetic Systems for the Metals Industry.