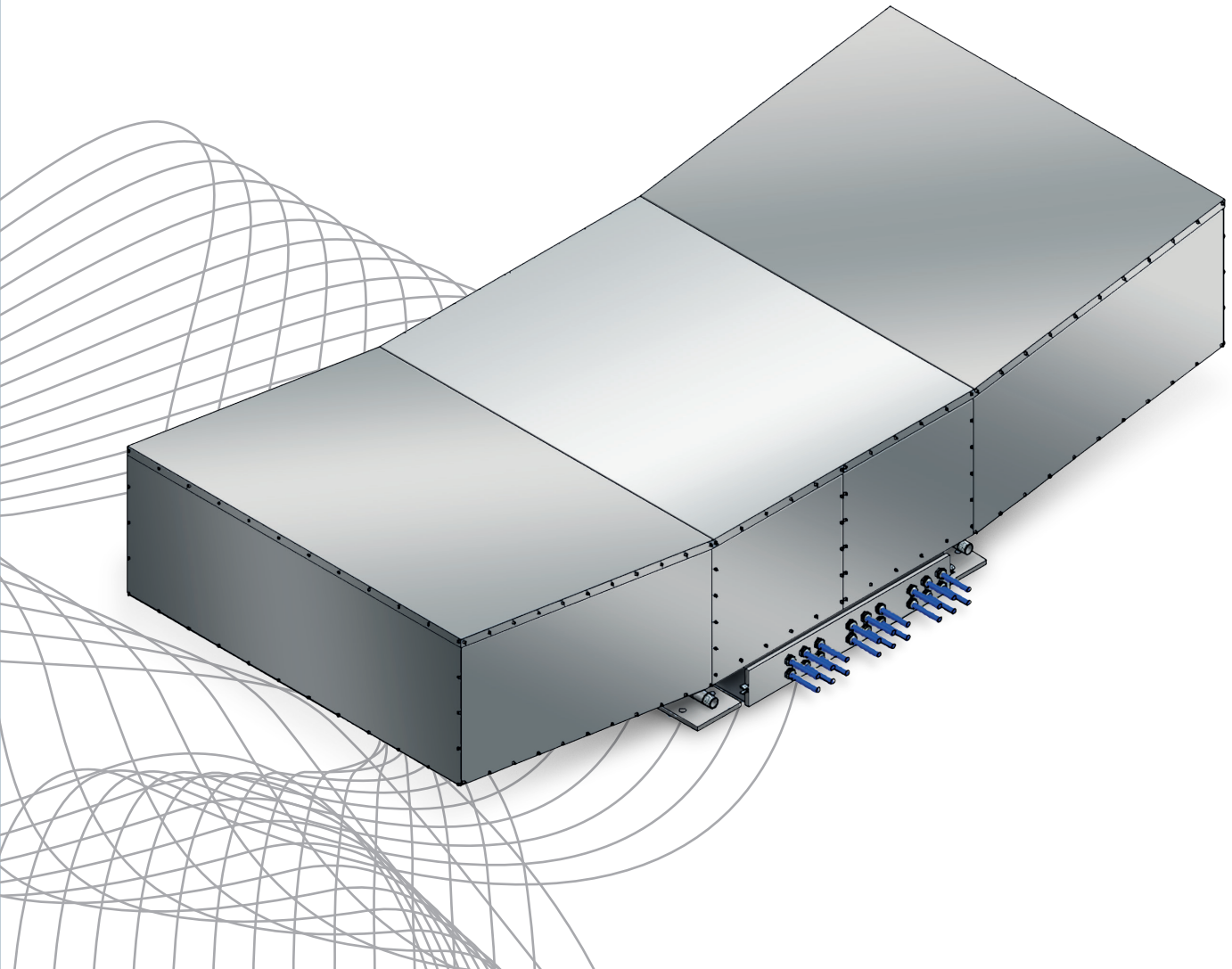
ergolines
INNOVATION PARTNER

EAF EMS – ELECTROMAGNETIC STIRRER FOR ELECTRIC ARC FURNACE

Electromagnetic stirring in EAF was developed 70 years ago for the secondary reefing phase of the EAF. Nowadays electromagnetic stirring is the perfect tool for increasing the kinetics in the EAF and it is a proven and reliable technology with inexpensive operation able to reduce the EAF operation cost, by saving time, energy and materials.



WHY EAF STIRRING IN MODERN FAST EAF

Following problems can be caused by very short tap-to-tap time:

- unmolten scrap, especially in EBT area
- high FeO level in slag
- high oxygen level in steel
- temperature and chemistry stratification across the bath
- low free opening ratio of tap hole
- scrap cave-in and electrode breakage
- cold boil.

EAF STIRRING BENEFITS

EAF Electromagnetic stirring affects the following areas of steel making:

SCRAP MELTING

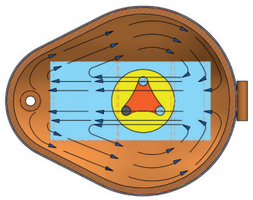
Even melting of scrap in the furnace, reduced cave-ins, less electrode breakage occurrence, large scrap pieces and bundles easily melted thanks to a convective heat distribution, less need for scrap stratification in scrap bucket, no unmolten scrap in EBT or at slag door.

ARC STABILITY, ELECTRODES

Quicker stable arc in each bucket, higher average power, decreased electrode consumption.

SLAG CHEMISTRY

Electromagnetic stirring reduces the oxidation of Fe and Mn under the oxygen lance and improves the reduction of the slag. Lower and more consistent temperature of slag improves slag foaming → less FeO and MnO in slag, improved yield.

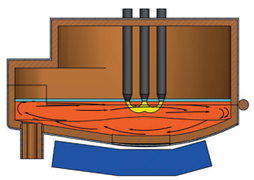


OXYGEN IN STEEL

Electromagnetic stirring drastically reduces super-saturation of oxygen in steel → consistent oxygen level from heat to heat, reduced consumption of de-oxidants in the ladle.

DE-CARBURIZATION

Electromagnetic stirring drastically improves de-carburization rate in steel de-carburization, by a factor of 2 → lower oxygen consumption to get the same de-carburization, consistent de-carburization to low C-levels.



BATH HOMOGENIZATION

The steel bath is completely homogenized; temperature, oxygen and chemistry sampling are representative, no super-heated or partially melted slag.

REFRACTORY

EAF-EMS does not require any special refractories. No super-heated slag or bath improve refractory wear; lower FeO content makes slag less chemically aggressive; total refractory consumption is lower; tap-hole life is improved.

ENERGY CONSUMPTION

Efficient heat distribution from the arcs to the bath lowers energy losses, increases productivity, further reducing energy consumption.

TAPPING

- Hot EBT area → improved free opening of tap-hole by 100%
- vortex suppression → less slag carry over
- less steel temperature variations, longer tap-hole life.

SAFETY, RELIABILITY

100 % free opening of EBT tap hole, reduced frequency of scrap cave-ins and electrode breakage, reduced frequency of cold boils in furnace, less sampling required, no scrap in slag door, representative samples, easy operation from the furnace automation system, minor need for maintenance.

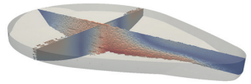
PRODUCTIVITY

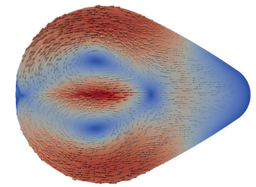
Factors discussed above increase productivity by more than 5 %, improved free opening of stir plug in ladle at ladle furnace and less chance for missing connection at caster.

EAF STIRRER INSTALLATION AND DESIGN

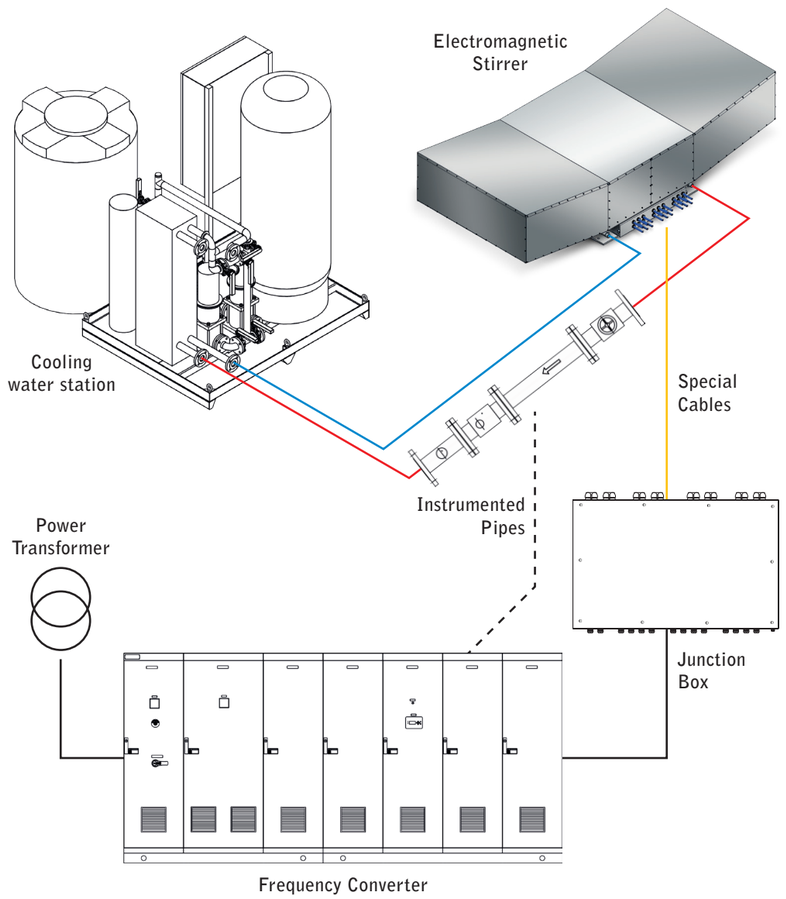
The stirrer is placed under the EAF furnace on the rocker. A non-magnetic window in stainless steel is needed at the furnace bottom; normal refractory lining can be used.

EAF stirrers are designed and optimized for each furnace by means of electromagnetic and fluid-dynamic simulations.





TYPICAL ERGOLINES EAF STIRRER SYSTEM



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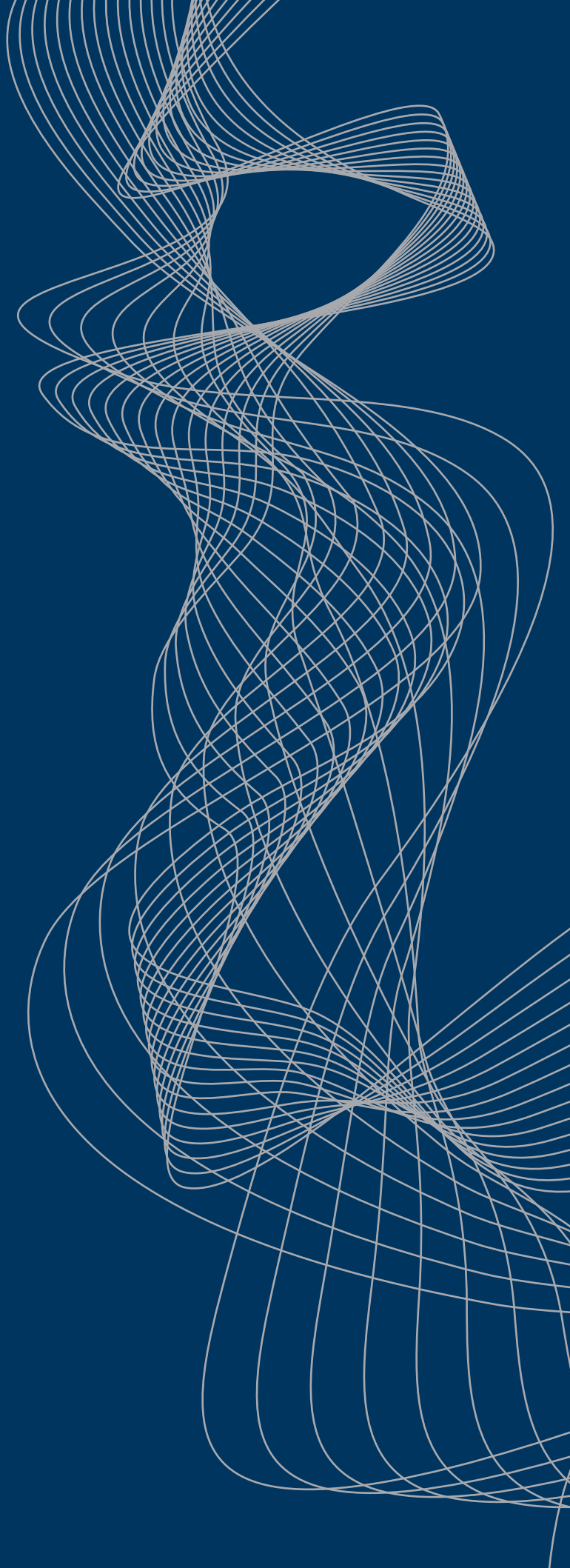

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