

needed and resulting stirring power are more appropriate for stirrers of this size. In addition, air-cooling systems require the use of filters, which should be changed on a regular basis, resulting in a higher level of maintenance than liquid cooling systems.

For larger stirrers on furnaces producing more than around 40 tons, liquid cooling is deemed to be more appropriate. As a rule, more cooling power is required for larger EMS systems. A liquid cooled EMS is well-equipped to deal with these demands and at the same time remains compact in size. Any benefits associated with the use of a considerably larger, equally powerful air cooled EMS cannot be justified when compared to the practical difficulties involved. Since liquid cooling consists of a closed loop water circuit, there is no need for filters less maintenance is therefore required. Careful analysis of installations confirms that liquid cooling offer a superior level of reliability for more powerful EMS systems.

Fitting

Traditionally, EMS systems have been fitted to the bottom of the furnace as standard. A bottom mounted EMS benefits from being fitted on the furnace bottom where there is maximum potential for optimum stirring. Stirrers mounted on the side will usually experience a certain loss in performance compared to bottom-mounted stirrers. The side-mounted EMS was developed and patented by ABB to satisfy the need for stirring where bottom mounting is not possible, for example stationary furnaces. To ensure maximum performance the EMS should be bottom mounted where possible.

It has been said that there are less complications involved in the installation of side mounted EMS as compared to the bottom mounted variety. This may well be true. Based on our considerable experience, it must be said that the long-term benefits of bottom mounting by far outweigh the short-term inconvenience associated with installing a bottom-mounted EMS system.

For the above reasons our customers have chosen side mounted only four times out of 250 installations. ABB can conclude that bottom mounted EMS should be

recommended over side mounted and side mounted should be recommended over not having EMS at all.

Process benefits are achieved through metallurgical improvements, which are driven by forced convection. When the magnetic field is introduced into the aluminium bath, an eddy current is produced, repelling the magnetic field and causing movement in the aluminium bath. The resulting rotation brings the cold bottom melt to the hot surface and the hot surface aluminium to the cold bottom. Any size of aluminium bath can, in as little as two minutes, reach a temperature homogenisation with a difference of max $\pm 5^{\circ}\text{C}$. This can be compared to a typical temperature difference of $70\text{-}100^{\circ}\text{C}$ in the absence of stirring. A lower surface temperature allows for more effective heat transfer from the burners, and furnace roof radiation is therefore increased.

Productivity is improved and dross generation decreased, which in turn leads to a higher aluminium scrap yield. An increase in productivity means that less energy is needed to reach the desired casting temperature. Moreover, the number of rejects due to faults caused by variations in casting temperature is greatly reduced. While alloying, electromagnetic stirring results in chemical homogeneity, decreased alloying time and increased alloy yield. The EMS dissolves alloys, such as Fe, Si, Cu, with a higher melting point more efficiently on account of the movement of the molten aluminium, which constantly feeds the liquid surrounding the alloy with unsaturated, hot aluminium.

Conclusion

In supplying 250 EMS systems for aluminium, ABB has gained invaluable knowledge and expertise which allows us to address the debate surrounding energy efficiency, choice of cooling system and fitting position on the furnace. As predicted, analysis of the facts confirms our original statement; a comprehensive range of energy efficient products, carefully selected on the basis of customer needs, is a prerequisite for providing customers with tailored solutions and guaranteed results. www.abb.com/metals ■