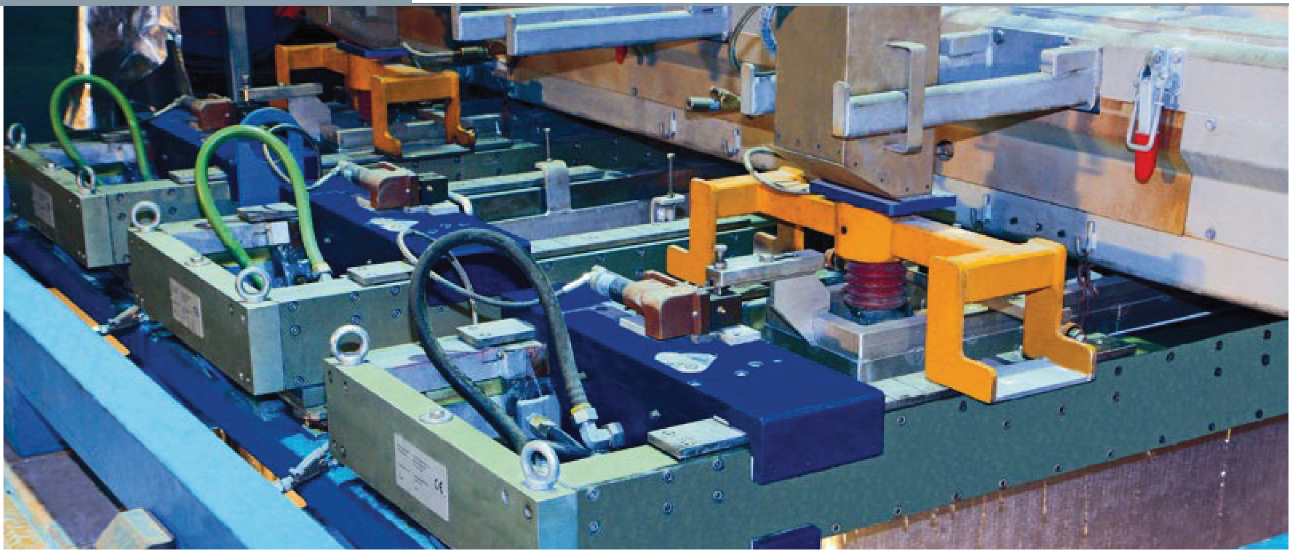

View of the new EMC plant

# EMC technology raises quality and cost efficiency

**With the new electro magnetic (EM) caster, AMAG casting GmbH has both increased its capacity and established a technological benchmark for the future.**

## Start of the first EMC plant in 1988

EMC (Electro Magnetic Casting) has established itself as the cutting-edge technology for the continuous casting of aluminium alloys and recent development work has further confirmed its outstanding advantages for the 2xxx, 3xxx, 5xxx and 7xxx alloy groups. EMC began in the late 1960's. At that time, a Russian team led by Z. N. Getzlelev developed the continuous casting of aluminium alloys in an electromagnetic mould. Then in 1973, the former Alusuisse purchased the Russian patent licences and brought the process up to large-scale production maturity. Subsequently Alusuisse also bought the rights to sell this technology to third parties and in 1988, AMAG decided to obtain EMC know-how and put a casting line into operation. The main task of the plant was to cast alloys susceptible to hot (3xxx, 5xxx) and cold (2xxx, 7xxx) cracking in rolling ingot sizes of 1,680 x 310 x 7,200 mm (width x thickness x length). The subsequent long-term operation of this caster then enabled AMAG casting to acquire comprehensive know-how in the field of wrought alloys susceptible to hot and cold cracking and on the basis of this experience, a second EMC system was installed in 2009. This new caster allows the production of rolling ingots with dimensions up to 2,320 x 600 x 7,200 mm (width x thickness x length).

## EMC technology in brief

EMC can be generally classified as belonging to the group of semi-continuous, vertical continuous casting processes in which metal feeding takes place via a melt distribution system consisting of a nozzle, a plug valve and a glass cloth filter sack. The contours of the solidifying metal are determined in a water-cooled mould. During conventional ingot casting, a pronounced shell zone with a thickness of some 10-20 mm is formed in the course of solidification as a result of the direct contact of the melt with the mould (please see Fig. 1 right). This shell is characterized by a coarse cell structure and an inverse segregation of alloying elements. Its thickness increases in a linear ratio to the length of the mould running surface (zone in which direct contact between the mould and the metal occurs) and this results in a large amount of milling swarf prior to rolling. In addition, mould lubricants (e.g. pastes containing graphite, etc.) are needed in order to ensure smooth casting [1].

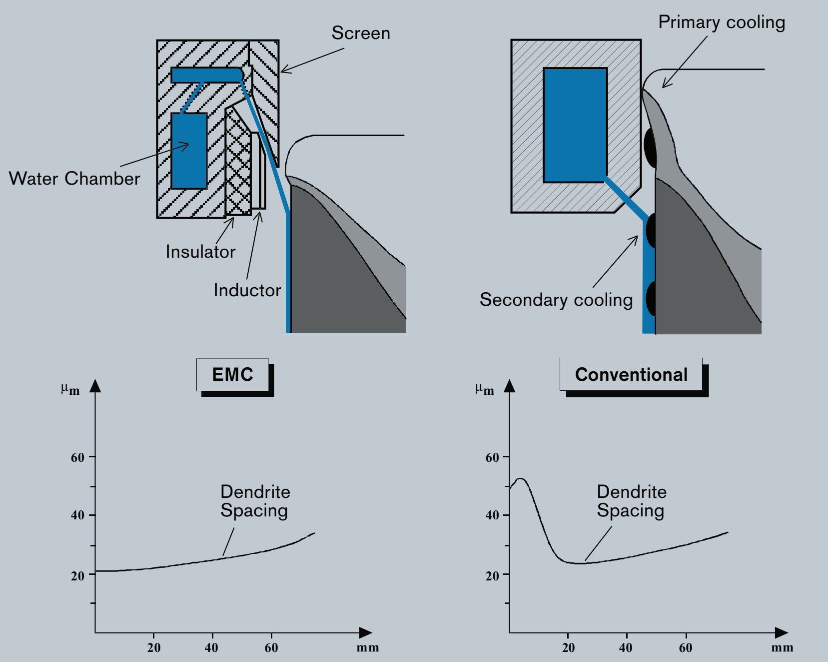


**Fig. 1:** Schematic diagram of the principles of conventional and electromagnetic casting, including the progression of the dendrite arm spacings in the edge zones

By contrast, EMC technology (please see Fig. 1 left) employs an ideal continuous casting mould, for as opposed to conventional solutions, there is no contact between the mould and the liquid metal. The latter is kept in a suspended state by means of electromagnetism derived from a force field generated by high-frequency alternating current. As a result, solidification of the melt is contactless, which prevents the formation of an inhomogeneous shell zone. This means that by using this technology, ingots with a very smooth surface and a homogenous microstructure can be produced. As a consequence, usually no post-treatment involving milling of ingots and edge trimming of hot rolled strip is required [2-4].

## Advantages of the direct combination of EMC technology with the rolling process

If one considers the economics of EMC technology purely from the perspective of the cast house, then a false, negative picture could result. For as compared to conventional casting technology, the EMC process has a number of disadvantages:

- High investment costs
- Complex plant automation
- High running costs due to the electrical energy requirement
- The need for comprehensive know-how

However, if one extends this limited field of vision to include the further processing phases included in subsequent rolling, these problems can be clearly counterbalanced. In the final analysis, the economic advantages generated by EMC technology are as follows:

- The reduction or avoidance of edge cracking during hot rolling:
  During hot rolling, conventionally cast, hard alloy rolling ingots are subject to highly prevalent edge cracking. This leads to an increased volume of edging scrap and a considerable reduction in the working width of the hot strip. Edge cracks derive from the presence of a distinctive casting shell on the narrow face of the rolling ingots. This reduces surface strength and thus leads to the formation of cracks caused by the forces exerted during hot rolling.
  The only help in this situation is the use of an edge-milling device, but as a result of limited throughput and increased demand for material removal, this is uneconomic. By contrast, owing to their smooth cast surfaces, rolling ingots derived from EMC technology do not require any upstream edge milling.
- No necessity for milling prior to rolling:
  No primary cooling is used in the EMC technology. Therefor no separation of the strand shell from the surface of the mould takes place, which logically enough also means that so-called remelting of the already solidified strand shell with the formation of a segregation zone is avoided.

For these reasons, EMC rolling ingots have a smooth cast surface and a cell size that increases steadily from surface to core (please see Fig.1) [4], which makes surface milling unnecessary.

**The enormous potential of EMC technology can therefore only be exploited, when as at AMAG in Ranshofen, an integrated plant with cast house and rolling mill is in operation.**

The advantages discussed facilitate a remarkable reduction in material removal requirements at the rolling mill of up to 10 per cent. In turn, this lowers the amounts of internal cyclical scrap produced and eradicates process steps, with the result that major savings of both energy (melting of the cyclical scrap and milling) and costs are created. Therefore, if the cast house and the rolling mill are considered jointly, the higher investment and running costs relating to the use of EMC technology in the cast house are transformed into an economic advantage in tandem with a simultaneous improvement in product quality.

**As a consequence, together with its sister company, AMAG rolling, AMAG casting is in a position to offer AMAG customers a highly innovative product that is both cost-efficient and ecologically optimized.**

## To sum up!

As a result of the installation of a second EMC technology caster, AMAG casting has succeeded in both extending top casting quality to an enlarged product range and strengthening its claim to be a premium producer of rolling ingots.

Removal of the ingots from the casting pit

Casting recipes for new alloys are being continually created on the basis of long-term experience and comprehensive operator know-how. Moreover, an overview of the complete process chain from the raw material to the end product in the rolling mill shows that the use of an EM caster for numerous products (which were previously cast conventionally) raises output, as milling is no longer needed. Furthermore, the new caster has facilitated an increase in the thickness range from 310 to 600 mm.

Consequently, EMC technology from AMAG casting creates the possibility of producing a larger range of rolling ingots with continuous casting quality of the highest standard. This advantage is then passed on directly to customers by the immediately adjacent AMAG rolling GmbH rolling mill in the form of innovative rolled products.

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