

Innovative Non-Radioactive Steel Level Control for Open-Stream Casting



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This article introduces an innovative technology for steel level measurement in open-stream casting based on the “thermal profile” of the mold copper tube. This technology is contactless and based on ultrasound waves, therefore no sensors embedded in the copper tube are required. Some additional features of this solution are presented, as well as some figures in comparison with the radiometric system in terms of measuring range and response time.

It is well known that the stability of the liquid steel level in the mold is a main factor to produce high-quality steel, in addition to process security. In fact, many quality problems are related to mold level fluctuations and other events in the meniscus region.¹ Furthermore, the formation of the first solid skin is a crucial step of the continuous casting process since it directly affects the occurrence of defects in the cast products.²⁻⁴ On the other hand, an unstable steel level may lead to defects, breakouts and overflows. Consequently, keeping a stable steel meniscus in the crystallizer is a key competitive factor for both quality and productivity.

Radiometric and electromagnetic level detectors currently represent the most widespread systems for steel level control, while possible alternatives include thermocouples (TC) and optical fibers (OF). However, all these solutions display important limitations in terms of installation and/or maintenance: In fact, TC and OF require an invasive installation, since the probes must be cemented into the copper tube/plates with expensive machining; on the other hand, radiometric systems imply strict safety management related to radioactive source handling and disposal. Finally, electromagnetic sensors, which measure the variation of the temperature-dependent copper impedance, are typically characterized by a limited

measuring range and a complex calibration procedure.

To overcome these limits, Ergolines developed a non-radioactive system for steel level control in oil-lubricated open-stream casting which is fully contactless, being based on ultrasonic technology (UT-LEVEL). The main system component is Ergolines’ Ultrasonic Level Detector (ULD): Being contactless, the system does not require any invasive machining since it is installed directly in the water jacket, with no need to embed any probe into the copper tube. Besides being completely non-radioactive, the system features an additional added value: it provides the real-time “thermal profile” of the copper tube at the meniscus.^{5-13,15} The system is a mature technology and a reliable alternative to the radiometric sensor for steel level control in oil-lubricated open-stream casting, as proved by several installations worldwide.

System Installation in the Mold

In the case of billets and blooms, the ULD sensor is installed in the water jacket (Fig. 1). Typical installation of the sensor is in the water jacket or in the backplate, where the machining is reduced to a minimum. Based on ultrasonic technology, the sensor is not in direct contact with the copper: Contrary to TC and OF, there is no need to embed probes