CONCEPT OF DESIGNING STATE-OF-THE-ART STEEL CASTING SYSTEMS AND REFRACTORIES FOR THEM ON THE BASIS OF INNOVATIVE SOLUTIONS

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Abstract

The article discusses basic concepts of designing state-of-the-art steel casting systems and refractories for them on the basis of innovative solutions using the example of new model of VT-60/80R slide gate for ladles with the capacity of up to 160 tons.

**Keywords:** refractories, slide gate, steel casting systems, innovative solutions

MAIN TEXT

Scientific-Manufacturing Enterprise (SME) Vulkan-TM has been working in the steel casting equipment market for over 16 years. All this time the development of the VTM slide gates has been based on various concepts ensuring competitive advantages that have always met the requirements of their time. Innovative solutions used for gate designing have been recognized by the customers; this fact is confirmed by high reliability level and, first of all, steel casting system accident-free operation.

Concepts of new generation VT slide gate configuration (Fig. 1) are based on already well-proven solutions as well as on fundamentally new ones [1, 2].

![Fig. 1 – VT-60/80 slide gate](image)

The new concept of the state-of-the-art steel casting system configuration by Vulkan-TM is based on the gate capability to adapt to using slide gate plates of different nominal sizes and various brands.

For slide gate casting, transition to plates of other nominal sizes has always meant only one thing – the necessity to replace the slide gate model, or, at best, its fundamental modification that does not always satisfy the conditions of dimensional limitations and possibilities of retaining mounting seats. It is obvious that all such associated changes are characterized by the respective money and time expenditures.

The idea to overcome dependence on using plates of one nominal size in a slide gate is of current interest nowadays. Well-known European manufacturers of steel casting systems such as Interstop, Vesuvius and others that also produce slide gate ceramics apply in their models patented solutions for fixation of slide gate plates in metal shells which necessarily have structural elements
(slots, flanges) corresponding to mating parts of mounting seats. Evidently, there is no possibility to use plates from other manufacturers; thus, the customer has to buy slide gate ceramics of the same manufacturer.

If we speak about use of imported slide gates in the Russian market, such binding to one manufacturer significantly influences the specific costs per ton of cast steel, places the customer in tremendous dependence and initially deprives the customer of any alternatives.

At present time the number of slide gate plate suppliers has increased by several times over the last 5 years, and such tendency continues. Among the leading manufacturers of high-quality slide gate plates there are such countries as China, India, Spain and others, which offer plates in a wide price range, significantly cheaper than those to which the European slide gates are linked. Taking into account that progress in qualitative characteristics of the proposed plates has also made a great step far ahead (durability up to 10 melts), it is easy to suggest that operational characteristics of slide gate plates will be changing towards increase of their life cycles. Having this in mind, the potential capability to adapt the slide gate to new emerging types of plates with enhanced operational characteristics is a quite far-sighted solution.

The new model of VT-60/80R slide gate for ladles with a capacity of up to 160 ton has a universal mechanism for fixation of slide gate plates of various nominal sizes. It enables transition to a plate of other nominal size without removal from the ladle, and the time for such resetting of the gate does not exceed the average time for its maintenance when changing the slide gate ceramics.

The plate fixing does not require that mating elements should obligatory be present on its shell. The patented plate locking mechanism is simple and easy to maintain, it does not imply use of any additional peculiar appliances.

The concept of modular approach to the gate configuration which formed at the dawn of the company development and became a traditional feature of the entire model range of SME Vulkan-TM gates is used in the new VT-60/80R gate model as well and is even more pronounced than earlier. This slide gate has a “foldable” configuration; it is functionally divided into unified blocks that can be replaced directly on the ladle and their retrofit or modification does not require any modifications of the gate in general. The modular replacement of the structure elements significantly reduces time for the gate maintenance on the ladle.

Two gate variants (with a side (Fig. 1, a) and a vertical opening (Fig. 1, b)) are designed for various operation conditions. The gate design provides for gate installation on the existing mounting seats and for easy adaptation for connection to drive systems already used at the enterprises.

An unorthodox solution for all VT slide gates is the clamping mechanism with two spring units consisting of heat-resistant disk springs carried out from the high-temperature heating zone.

For over 10 years SME Vulkan-TM has been manufacturing and delivering slide gate refractory products with various operational characteristics. At present time SME Vulkan-TM manufactures refractory products of durability comparable with the world main refractory suppliers such as RHI, Interstop and Vesuvius.

The results of VT-60/80R slide gate operation with a casting channel diameter of 60 mm have shown equal durability of nozzle-collectors and used slide gate plates reaching up to 9 melts. The slide gate plates here are still the element which limits durability of a refractory set, but with the appearance of slide gate plates having enhanced operational characteristics SME Vulkan-TM has all capacities to develop nozzle-collectors with the appropriate durability. As a comparison, durability of the cluster nozzle in the VT-60/80R slide gate comes up to 25 melts. Obviously, the next concept of designing state-of-the-art steel casting systems will be achievement of the similar durability of the cluster nozzle, slide gate plate and nozzle-collector.
LITERATURE
