PRECISION FEEDING IN LARGE CASTINGS

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Over recent years, the foundry industry has been increasingly challenged by constructional changes in the methods used to make castings in the drive to save material. This has made the task of ensuring efficient feeding of these castings more and more complex. While the focus in the past has been mainly on mass production in machine mould casting, this trend is now progressively finding its way into the hand-mould casting field. Ever-thinner wall thicknesses lead up to solid attachment points, which means that feeding material through areas with thinner wall thicknesses is becoming more difficult if not almost impossible. Nevertheless, the high-modulus areas in the component, in which the thermal centres lie, must be fed.

This can be accomplished with very small footprints using the legally-protected Sleeve Construction Kit (SCK) feeding system newly developed by Foseco.

THE CONCEPT

The SCK feeding system is based on a modular construction concept that makes it possible to cover the 5.4 cm to 6.9 cm modulus range using a small number of separate individual components. The use of larger feeders often involves enlarging the aperture and with that the footprint. This leads to increased fettling and cleaning costs.

If the aperture area is reduced, this runs the risk that the feeder neck becomes constricted. This in turn leads to secondary shrinkage pipes and the casting becomes unusable.

The SCK feeding system counteracts this effect without constricting the feeder neck. Fettling and cleaning costs are therefore reduced. The system is a hybrid system consisting of highly exothermic and insulating feeder components, which allows the requirements to be met by adopting the best possible balance of modulus and volume.

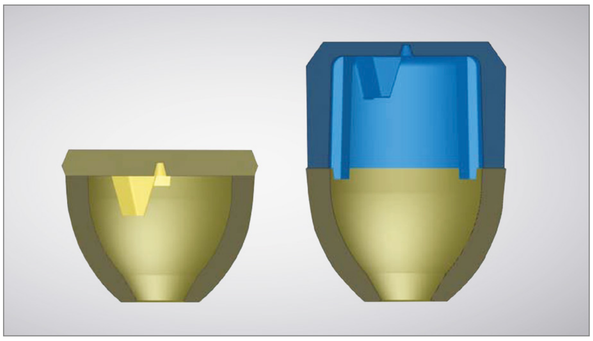

Figure 1.
Basic components:
5.4 cm modulus (left),
6.5 cm modulus (right)

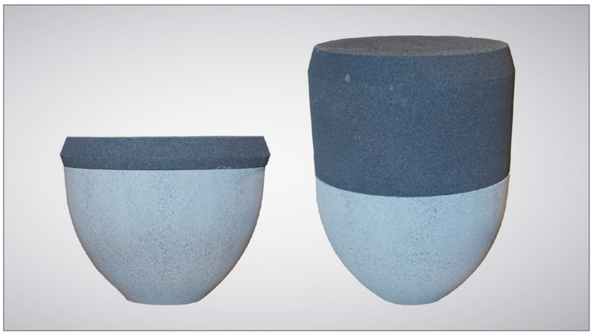

Figure 2.
Basic components:
5.4 cm modulus (left),
6.5 cm modulus (right)

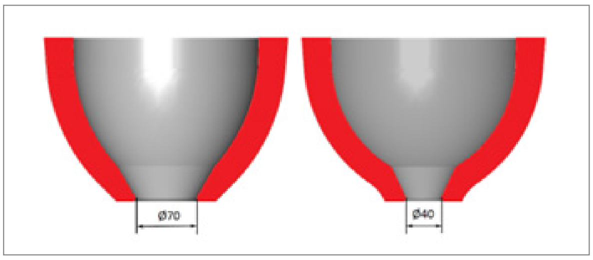

Figure 3.
Comparison of apertures:
70 mm aperture (left),
40 mm aperture (right)

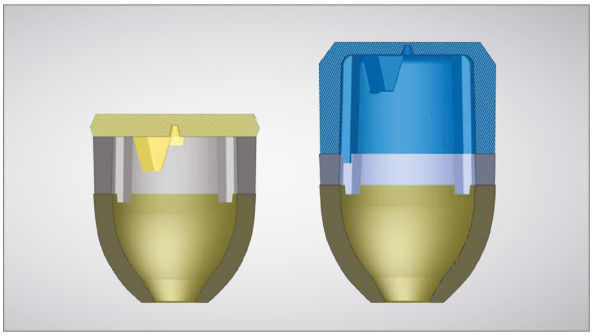

Figure 4.
Basic and add-on components:
6.0 cm modulus (left),
6.7 cm modulus (right)

CONSTRUCTION

The system consists of various components that can be put together in individual arrangements according to modulus and volume requirements. This is done with a simple plug-in system, thus dispensing with the need to glue the components together.

The basic system consists of a highly insulating bottom part with an integrated breaker edge as well as a cover lid or a cap-shaped topping made from highly exothermic feeder material. When the feeder is filled with liquefied material, this creates the required energy in the upper part of the feeder and keeps the liquefied metal in the lower part hot. Foseco uses the proven FEEDEX HD material for the exothermic components and the highly insulating KALMIN 250 for the bottom part. Integrated Williams wedges keep the surface of the molten metal open and therefore ensure optimum feeding.

When casting ferrous metals, the outstanding insulating effect of the bottom part allows the aperture to be reduced to as little as 40 mm with a footprint of only 90 mm (Figure 3).

COMPARED WITH CONVENTIONAL FEEDER TYPES, THE FEEDER NECK AND THEREFORE THE AREA TO BE FETTLED CAN BE REDUCED BY UP TO 75 %.

This allows the junctions for feeding to be positioned without problem.

The integrated breaking edge in the bottom part makes the feeder easier to knock off.

The highly insulating bottom part described above can be composed of various highly exothermic components according to need. It is therefore possible to feed castings with a 5.4 cm to 6.9 cm modulus with the smallest possible aperture and avoid forming cavities.

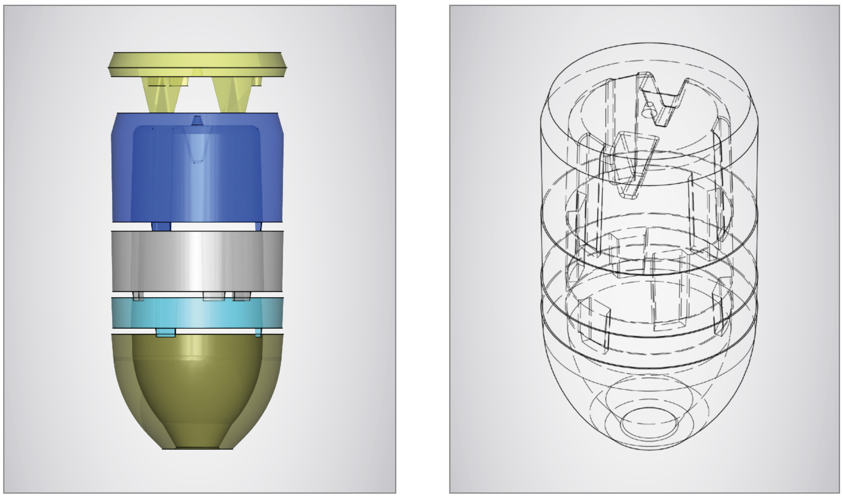

Figure 5: Modular construction – system diagram (left), wire model (right)

Figure 6: Cast feeder – 6.8 cm modulus

The necessary moduli and the required volume can be optimally achieved using various combinations of add-on components, which consist of two different rings with a height of 50 or 100 mm (Figure 5).

The modular construction of the SCK feeding system allows 16 different feeders to be assembled out of six components in the given modulus range. This system greatly reduces the diversity of types in conventional feeding systems and releases storage space. Figure 5 shows the various components. Exothermic cover lids are used for moduli up to 6.3 cm, while the cover lid is replaced by the top part for moduli of 6.5 cm or above.

The data sheet for the SCK feeding system also shows locating pins. Locating pins eliminate any invalid combinations, because they prevent the use of fewer or smaller add-on parts than specified.

Table 1 shows the combination matrix of the SCK feeding system with the corresponding basic and add-on components.

APPLICATION

Extensive test series were carried out at different foundries. Sample cubes were first cast and tested. The results were very satisfactory and confirmed the findings from the earlier Magma simulations.

Modulus [cm]	Vol. [dm³]	Bottom part SCK U			Middle part HD1 SCK M		Upper part HD1 SCK O 200	Lid HD1 SCK D 220
		Neck aperture			Hight			
		40	70	110 (for steel)	50	100		
5.4	4.4	X	X	X				X
5.8	6.2	X	X	X	X			X
6.0	8.0	X	X	X		X		X
6.3	9.8	X	X	X	X	X		X
6.5	9.7	X	X	X			X	
6.7	11.5	X	X	X	X		X	
6.8	13.3	X	X	X		X	X	
6.9	15.1	X	X	X	X	X	X	

Table 1: Combination matrix of the SCK feeding system consisting of basic and add-on components

Figure 7: Feeder arrangement – three 6.8 cm modulus feeders

Once the preliminary test series were completed, casting samples were taken from actual castings.
An aperture of 70 mm was used in the SCK feeding system for the first tests. The highly insulating material has already allowed the feeder aperture to be reduced to 40 mm on numerous applications. This dispenses with the need for laborious cutting off of the feeder neck during fettling. The amount of fettling of the castings required and the associated costs as well as the production throughput times are drastically reduced.

Figures 6 and 7 show a practical example. The roller casting made from GJS 600-3 with a casting weight of 1500 kg was cast using three 6.8 cm modulus SCK feeders (bottom part, 100 mm middle part, and top part), Figure 6. The bottom part had a breaking surface aperture of 70 mm.

The highly insulating effect of the bottom part in this system allows the feeder to be very narrow because there are no adverse thermal influences (Figure 7). The separate thermal centres positioned very centrally in the casting were advantageous in achieving optimum feeding.

Moreover, it is also possible to integrate the highly insulated bottom part in the form of a feeder base into the system to allow side feeding (Figure 8). Similar advantages also result for fettling and cleaning costs.

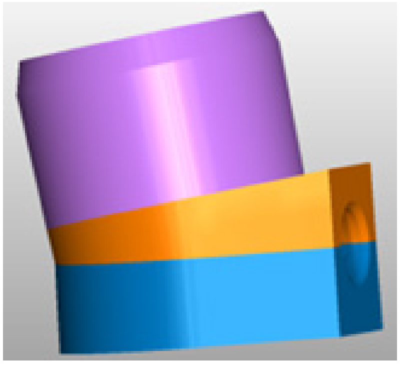

Figure 8. Feeder base with top part – 6.5 cm modulus

The highly insulating KALMIN 250 material used for the feeder base has the advantage that it can be easily shaped to achieve the casting contours. The material is very easy to remove using a file or similar abrasive tools.

A highly insulating bottom part capable of withstanding higher thermal loads is available for casting steel. In this case, the material is KALMIN 70. The diameter of the feeder neck was adapted to the steel application.

With a neck of 110 mm and a footprint of 160 mm, the feeder can be easily positioned on the corresponding model contours. The integrated breaking edge facilitates the separation of the riser from the casting.

For applications with an open riser, it is possible to position several rings on the lower part and cover the riser with covering powder after casting.

The add-on components discussed above can also be used here. An aspect not to be underestimated when dealing with high-modulus feeders is the weight, which increases rapidly with the modulus value. The modular construction of the SCK feeding system allows the components to be introduced into the mould separately and connected together there. From an ergonomic point of view, this makes the task of the foundry operatives considerably easier.

SUMMARY

Using the SCK feeding system has many advantages for foundries and their operatives. The lower need for storage space, reduced fettling, cleaning and grinding costs, ease of assembly and an improvement in working conditions mean this system represents a great step forward in cost minimisation in foundries.

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