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Reducing costs with innovative feeder systems

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Innovative feeder systems

The continued trend towards increasingly complex and filigree castings followed by the design engineers and foundries seeking to gain performance and cost advantages calls for consistent further development of tried and tested, traditional feeder systems. The feeders of the PX-ME N product line offered by GTP Schäfer, Grevenbroich/Germany, that generate cost advantages in serial production, were specially designed to meet the foundrymen's current requirements in a fast growing market environment. After a successful product launch, positive results are available

Nowadays, foundries worldwide are facing significantly altered requirements in terms of process optimization, productivity increase, reduction of cycle material from the feeding and gating systems, and the cost of machining and fettling along with the increasing technical sophistication in regard to intricate part geometries. To support the foundrymen in meeting these challenges, suppliers are asked first and foremost to develop innovative and process-optimized product solutions for and mutually with their customers.

The feeding technology available today in the foundry markets outside of Europe is dominated by conventional exothermic and insulating sleeves. In addition, sand risers are still often used in foundries. This technology only offers very limited efficiency and leads to a very poor yield. The efficiency of the different feeding technologies available today can be compared as follows:

For a 20 kg ductile iron casting the metal shrinkage can be estimated at approximately 5 %, which leads to a feed metal requirement of 1.0 kg. In order to provide such feed metal volume the risers mentioned in **Table 1** and shown in **Figure 1** would have to be applied.

As a summary of the table, it can be observed that the efficiency of the Point-Risers is far higher than the efficiency of a sand riser or a conventional exothermic sleeve. While a sand riser with an efficiency of approx. 13 %

Burning exothermic riser (Photos: GTP Schäfer) would have resulted in an 8 kg riser rest, the conventional sleeve would have been lighter with a riser rest weight of 3 kg. By the application of the Point-Riser with an efficiency of 60-70%, the riser rest weight would be reduced to less than 1 kg. In the mentioned case of a 20 kg casting the yield could be improved sharply by the use of this innovative technology.

Also for threshold countries such as India, China and South America, the efficiency of a riser system is becoming an increasingly important aspect. These countries have historically benefited form lower conversion costs due to more favourable energy and labour costs. However, also as these countries are developing further, these cost positions are increasing and are influencing the overall profitability of the foundries.

In addition to the far lower efficiency of the above mentioned "traditional" feeding technology, the problem is often increased due to the fact that the relevant hot spots are located in the centre of the casting. In order to feed these central sections, the side risers will have to assure the long feeding distance, which often requires an even larger side riser. Therefore at many foundries feeding pads are added in order to better reach the hot spot with the side risers. These material additions are often not accepted by the customer and therefore need to be removed during fettling/machining of the casting. This again increases fettling and throughput times as well as the risk of scrap due to fettling operations.

In order to offer their customers a serial product that represents a significant value added in the form of cost and efficiency benefits, GTP Schäfer introduced its proprietary "Point"-Riser portfolio. In 2003, the first feeders with metal sheets ("PX-ME N") were presented to the international foundry industry. The Point-Riser portfolio is shown in **Figure 2**. These

Riser Type	Efficiency [%]	Riser rest weight [kg]		Compared to sand riser [%]
Sand Riser	10 – 15	approx. 8	➡	100
Exothermic Sleeve	25 – 35	approx. 3	➡	38
Point-Riser	60 – 70	approx. 0,7	➡	8

Table 1: Efficiency chart

Figure 1: Comparison of sand riser/exothermic sleeve/Point-Riser

Figure 2: Point-Risers portfolio

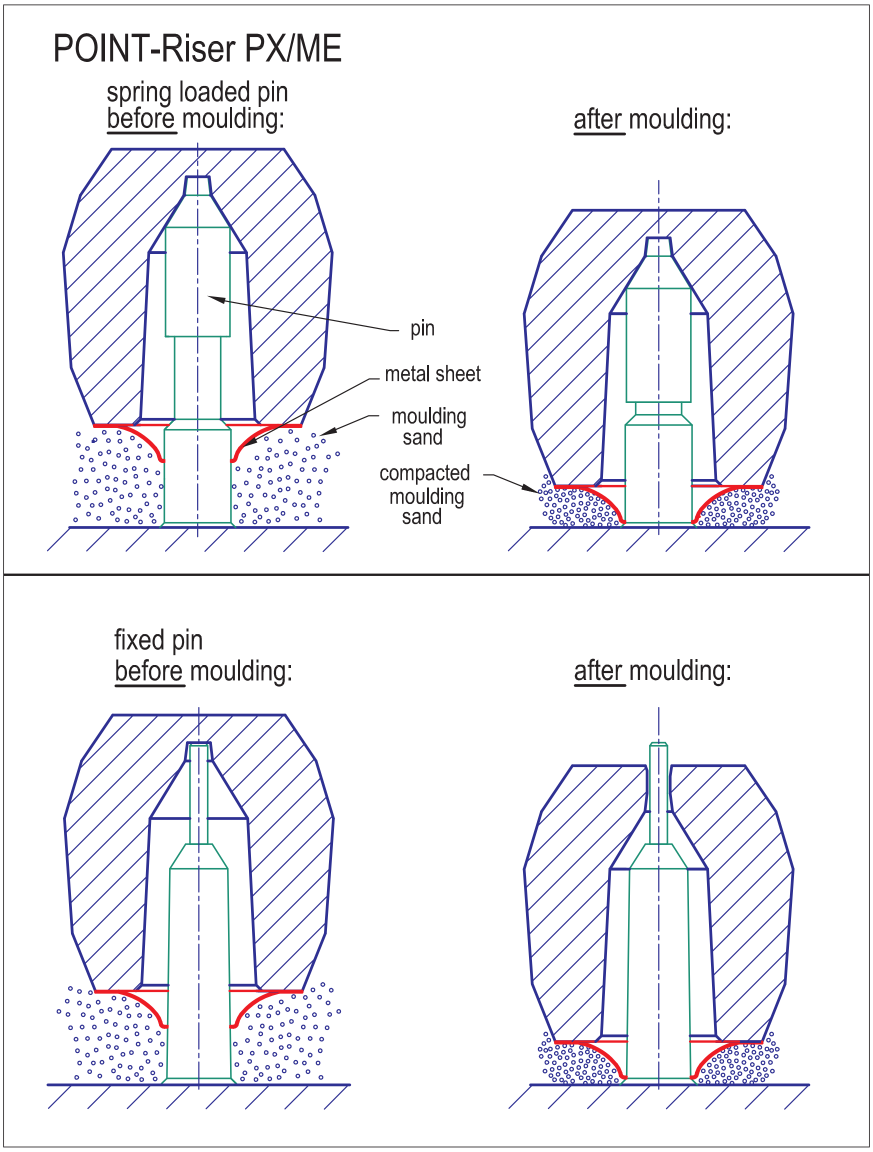

Figure 3: Application technology with spring-loaded and fixed location pin

Figure 4: Point-Risers positioned on pattern plate

feeders were developed to meet the demand for increasingly smaller feeder-to-casting contact areas on complex pattern contours and the rising compaction pressures of the moulding machines.

Product description and properties

Point-Risers have a self-centering shape whose large internal diameter is reduced by a smaller aperture of the accessory glued to the feeder to generate a smaller feeder neck profile. Optionally, this add-on device can be a traditional breaker core, an exothermic reduction plate, or a flat metal sheet.

In addition to the above-mentioned alternatives, the self-centering Point-Risers are also available with a metallic breaker core, or “ME metal sheet”. It comprises a convex metal sheet firmly joined to the feeder body. Its major advantage is the high mechanical loadability of the metallic breaker core that convinces through its significantly higher process safety, especially on state-of-the-art high-pressure moulding machines. The ME metal sheet is available with bore diameters ranging from 15 to 40 mm depending on the modulus of the feeder as well as the individual application (e.g. material characteristics). Moreover, oval bore diameters (20 mm x 30 mm) are available for narrow and elevated positions, such as flanges, that only have a wall thickness of 20 to 30 mm but require the largest feeder neck possible.

This development is a further step on the way towards expanding the tried and tested modular system of Point-Riser wherein the feeder system is tailored to the needs of customers and processes.

The feeder can also be customized in regard to the choice of the feeder material. If, for instance, the customer wishes to avoid fluorine contamination of the sand system from the feeders to meet the disposability criteria of returned sand, it is possible to choose

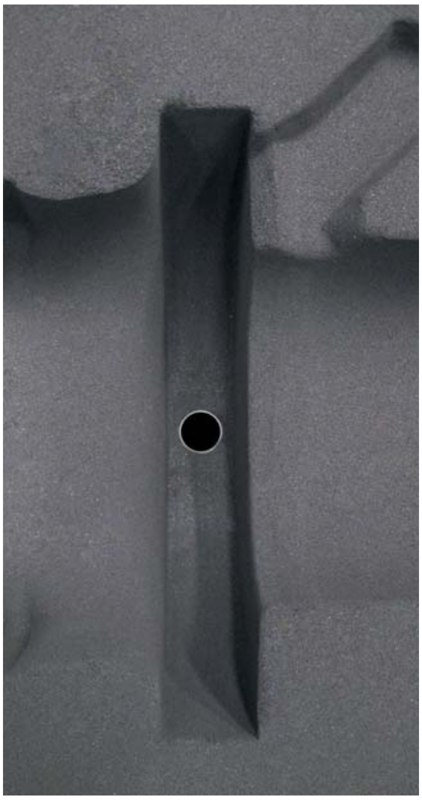

Figure 5: Point-Risers feeder neck in the mould after compaction

Figure 6: Knock-off area

fluorine-reduced or fluorine-free feeder material instead. For larger feeder modules, it is best to increase the insulating properties of the feeders.

Application technology

The feeders of the PX-ME N series offer the foundrymen a wide range of possibilities in regard to the moulding technology to be applied, making it possible to tailor the application technique to the individual casting conditions. For the self-centering inner contour of the Point-Risers both spring-loaded and fixed location pins can be used to hold the feeder above the pattern contour prior to compaction. **Figure 3** shows a schematic example of a PX-ME N feeder before and after compaction with spring-loaded or fixed pins.

During compaction of the moulding sand, the high mechanical pressure applied by the moulding machine squeezes the ME metal sheet with the feeder previously held upright towards the pattern plate, thereby forming a predefined breaker edge right on top of the casting surface.

For optimum setting of the pin height, the ME metal sheet has to be held on the pin above the pattern (**Figure 4**), because the metal sheet will be pushed down to the pattern plate during the mould compaction process. Variations in the pin height make it possible to streamline the process parameter "height of feeder neck" in regard to process safety and stability.

The lower end of the pin can have an additional bevel edge depending on the material, machining allowance, and location. It avoids damage to the casting surface by feeder rests breaking into the casting during knock-off.

After compaction, the Point-Riser fits against the pattern contour with the edge of its metal sheet (**Figure 5**). Thus the locating surface of the feeder is only marginally larger than the selected riser neck diameter of the ME metal sheet.

The novel Point-Riser technology with ME metal sheets makes it possible to apply feeders to small, irregular, or even bent surfaces without risk of damage to the breaker core. This feeder system significantly enlarges the field of application of feeders, especially on extremely small or protruding locating surfaces, such as cams, knuckles or flanges.

Moreover, these sleeves significantly reduce the length of the feeder neck, which in turn lessens the risk of early "freezing" of the feeder neck.

Optimum sand compaction underneath the feeders is another advantage achieved by the fact that the PX-ME N feeder is held upright by the pin prior to compaction.

Knock-off behaviour

An accurate predetermined breaking edge formed by the ME metal sheet (**Figure 6**) immediately above the casting surface facilitates the efficient and safe removal of the feeder rest in the fettling shop. The minimized locating surface of the ME metal sheet creates a high-quality surface (Figure 6). The fettler is relieved from the tedious task of extensive grinding of the casting around the feeder neck. This reduces the throughput times of the castings, as well as the fettling time. In addition, the risk of scrap caused during fettling is reduced due to defined breaking edges and less complicated fettling operations.

Cost advantages for serial production

Due to the unique capabilities of the Point-Risers, the PX-ME N series provides foundries with a highly cost-effective alternative. To date, the cost savings have far exceeded the costs for the risers. The saving potentials can be summarized as follows:

1. Yield improvement due to higher efficiency of exothermic Point-Risers
2. Flexible allocation on extreme casting positions – directly on the spot
3. Higher efficiency of pattern space utilization - more castings per box
4. Reduction of scrap rate due to higher process stability
5. Reduction of fettling costs, scrap and time
6. Reduction of throughput time

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