EXOTHERMIC FEEDERS USAGE IN VERTICAL MOLDING LINE

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ABSTRACT

Exothermic feeders have been used in horizontal molding lines during many years without any problem; on the contrary there have been limitations in applying exothermic feeders to vertical molding lines. While vertical molding lines were introduced nearly fifty years ago, mainly sand feeders were used on castings. In following years, due to the competitive environment and total costs, foundries have started to decrease their unit costs. Therefore cost per castings must reduce by innovative solutions like exothermic feeders KALMINEX* and/ or direct pour systems KALPUR *. When these innovative products are used, casting yield is significantly improved and final total cost per castings decreased. Generally vertical molding lines are very rapid but have some disadvantages, for example; especially for heavy and thick section castings. When these castings are produced in vertical molding lines, problems with mold cracks, gas and shrinkage may appear. Mold cracks are often seen when using big sand feeders; this drives the need to use thinner and smaller feeders instead of big sand feeders. Another advantage of exothermic feeders is the ability to increase the number of castings per pattern when using direct pour units. This means that productivity and cost effectiveness are significantly improved.

Keywords: Exothermic feeders, Direct pour systems, Vertical molding lines,

1. INTRODUCTION

KALMINEX * exothermic feeders are highly effective in reducing riser size and providing consistent feeding performance versus sand risers and less efficient feeders. They improve foundry yield and significantly reduce feeder removal costs.
KALPUR * direct pour units are a combination of a feeder and ceramic foam filter. Liquid metal is poured through the KALPUR * direct pour unit into the casting. The KALPUR process entirely eliminates the need for a conventional running system.
Vertical molding lines feeding applications development has been much slower compared to horizontal molding lines. But lower process cost compared to horizontal molding lines and price pressure by the market, made it increasingly necessary to develop methods to produce heavier and more complex ductile iron castings on vertical molding lines. Therefore foundries have started to use exothermic feeders for improving casting yield and increasing productivity which could be improved by including additional cavities on the pattern plate. (Figure 1)

By using direct our unit for this casting, total cost per castings are reduced and comparison tables which are given in below (table 1)

Figure 1: Application of direct pour and insert sleeves to a ductile iron casting

Table 1: Comparison between conventional and modified KALPUR layout

Pattern layout	**Conventional**	**KALPUR Fe**
No. Castings/mould	2	2
Gating and feeding System Wt	11.5 kg	6.5 kg
Total pattern weight	23 kg	18 kg
Yield	50%	64%
Handling for fettling	3 x	2 x
Grinding Area / casting	11cm^2	9 cm^2
Pouring Time	9 sec	8 sec
Moulds / ladle	20 – 22	24 – 26
Productivity / ladle	-	+20%
Total scrap	8 - 9%	2 - 3 %
Additional cost / mould	-	1.10 euro
Saving / mould – Scrap	-	6%
Saving / mould – handling + Fettling	-	0.10 euro

In order for understanding the advantages of exothermic feeders instead of sand feeders, three different case studies have been prepared in Turkish major automotive foundries and details are given in below pages.

2. CASE STUDY 1- Eliminate Shrinkage Problems of Under the Feeder Neck Area

Foundry is suffering shrinkage problems under the neck area and nearly all castings are scrap due to shrinkage by using sand feeders. Therefore KALMINEX ZP 4/7K is chosen instead of sand feeders to eliminate shrinkage problems.

Casting properties are listed below;

Casting; Bracket
Alloy; GGG50
Casting Weight; 5.2 kg per casting, 35 kg 4 castings per mold
Pouring temperature; 1400 C,
Pouring time; 7.5 sec.

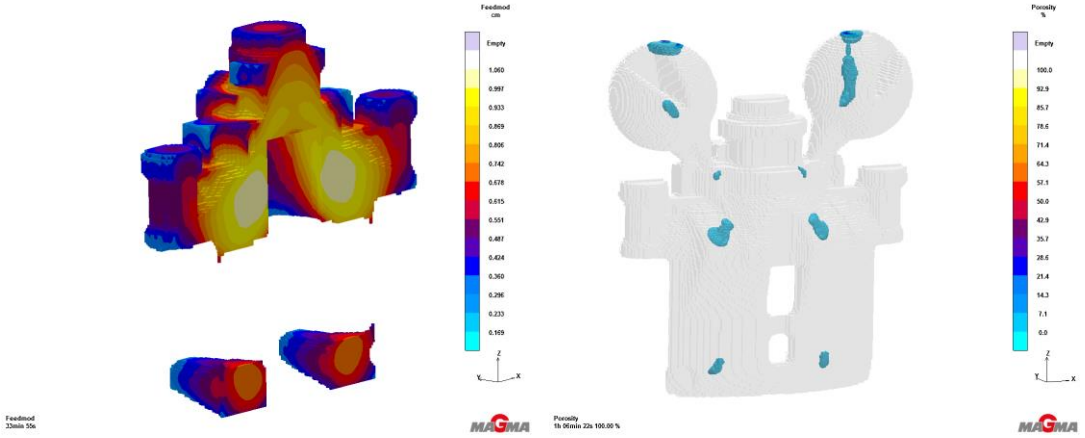

Figure 2: Magma simulation results for modulus and porosity views with sand feeders

After applying KALMINEX ZP 4/7K instead of sand feeders, all of the castings are sound and shrinkage problems could not be observed. Pouring weight has been decreased from 35 kg to 32.5 kg by using KALMINEX exothermic feeders. Metal savings per casting is 2.5 kg.

It is clear then that the foundry has started to produce sound castings and at the same time casting yield has improved from 59% to 65%.

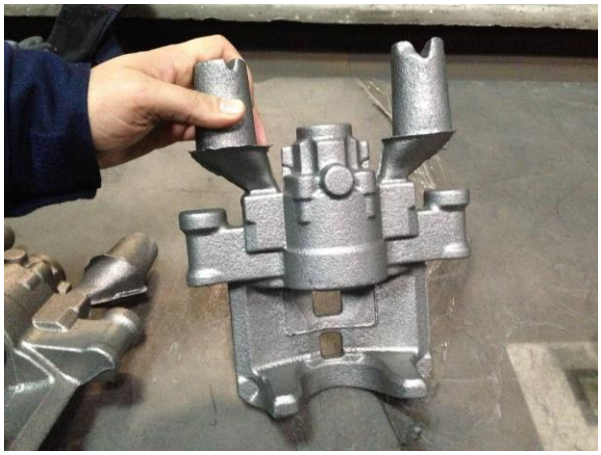

Figure 3: Sound casting with KALMINEX ZP 4/7K exothermic feeder

Improvements are listed in below by using exothermic feeders;

- Mold yield increased from 59% to 65%,
- Shrinkage problem solved,
- Productivity increased due to yield improvement,
- Grinding area reduced by 50%,

3. CASE STUDY 2- Increasing productivity by using direct pour systems

Foundry try to produce more castings on plate by using direct pour systems KALPUR *. Main aim of this study is to increase productivity and casting yield. Therefore a proposal was given for casting shown below.

Casting properties are listed below;

Casting: Caliper
Alloy: GGG50
Casting Weight: 3.5 kg per casting, 23.8 kg 3 castings per mold,
Pouring Temperature: 1410 C
Pouring Time: 8 sec.

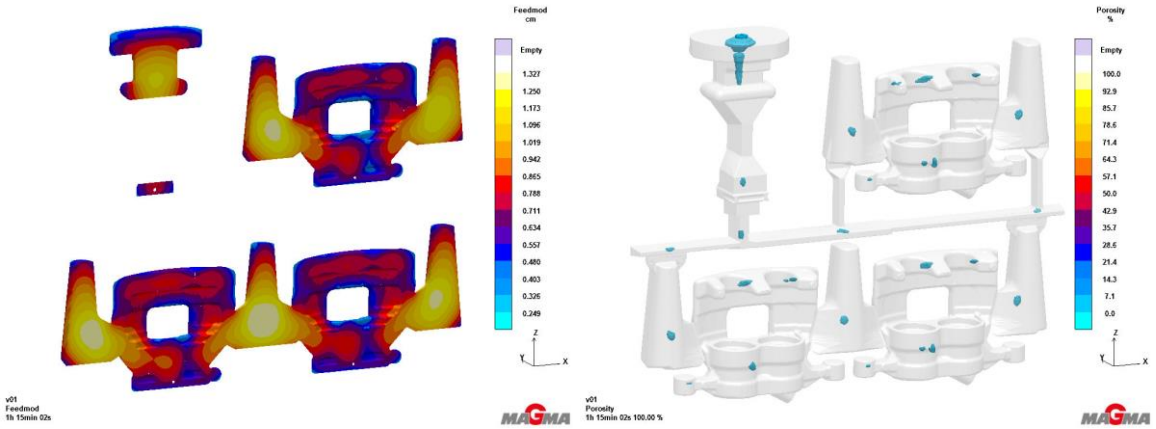

Figure 4: Magma simulation results for modulus and porosity views with sand feeders

Castings per plate increased from 3 to 4 by using KALPUR direct pour system.

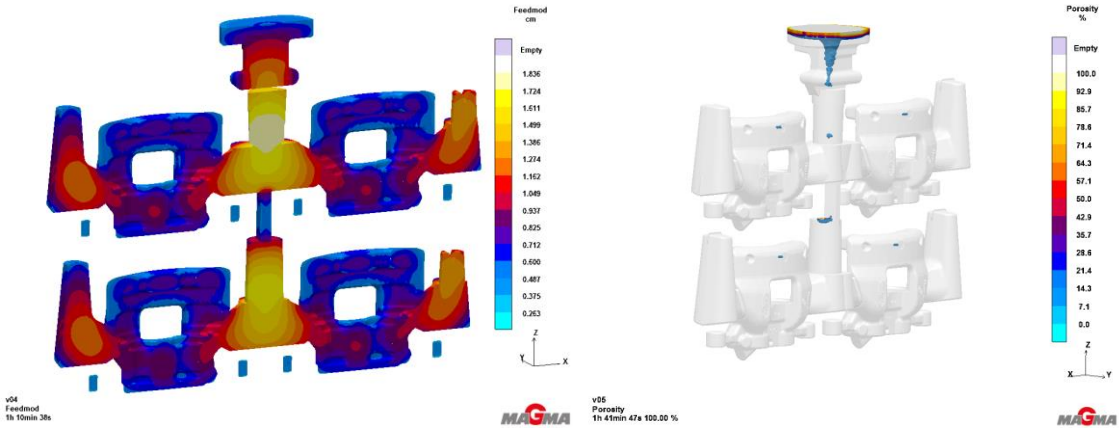

Figure 5: Magma simulation results for modulus and porosity views with KALPUR

As seen in Figure 5, direct pouring into side feeders with KALPUR gives the risk of slag creation similar to current 3 casting layout. But SEDEX foam filter minimizes the turbulence especially for the upper castings and the filter captures slag from the melt minimizing total slag amount.

Improvements are observed and results are confirmed by foundry. Improvements are listed below by using KALPUR direct pour system;

- Yield is improved from 44% to 50%, the limiting factor for yield improvement is the large feeder base required for each casting,
- Productivity increased due to 4 castings instead of 3, hence productivity increased by 30%
- Total mold weight decreased to 23,8 kg to 21 kg almost 3 kg saving per mold

4. CASE STUDY 3- Obtain sound casting by using isolation pad solution

Foundry has problem during knock-off operation from feeder to casting. It needs a special design isolation pad in order to improve knock-off and leads to smaller footprint area.

You can find in below photos, existing sketch is shown on the left side, also proposed design can be found in right side of photos. Total grinding area reduced from 2,475mm² to 490 mm². In addition the mold weight was reduced from 45.99 kg to 40.95 kg; it means 5 kg metal savings are obtained. In order to improve metal cleanliness, SEDEX 60x60x15/20 ppi (pores per inch) foam filter was used in this casting.

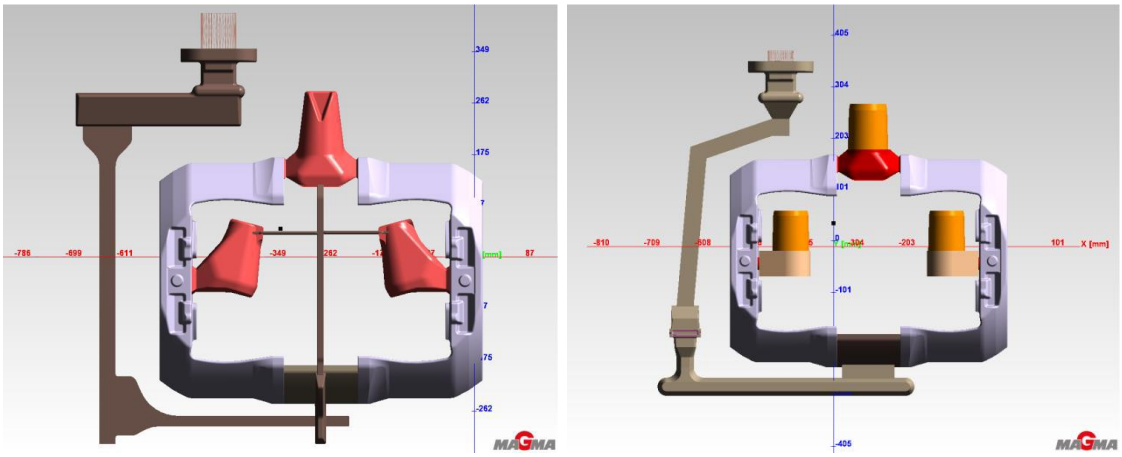

Figure 6: Magma simulation existing sketch (left), proposed sketch (right)

5. CONCLUSIONS

- 3 different trials were conducted with Turkish major automotive foundry and improvements are obtained with direct pour system, isolation pad and exothermic feeder solutions.
- Especially in Turkey, molten metal cost is dramatically increasing day by day; therefore foundries try to find solutions to decrease their unit costs.
    - Foseco has proposed exothermic feeders to increase casting yield,
    - Direct pour systems to increase productivity which means more castings produced with less molds, and less energy consumption.
    - At the same time proposal are given with isolation pad to obtain sound casting without any knock-off problems.
    - SEDEX filters are proposed to eliminate sand-slag inclusion problems.

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REFERENCES

1) FOSECO, Foundry Practice Magazine 247.
2) Foseco internal studies.