IN FORM

NEWSLETTER ISSUE I-19

Dear friends of the company, valued customers,

after presenting aspects of "cast-ready design" in the last two issues of **IN FORM** – still available for reading on our website – for the designers of our customers, we would like to give you today some insight into the casting simulation. While the technological development of the foundry industry continuously advances, nothing has changed for decades regarding the basic principles of the cast-ready design. They just need to be relearned by each generation of engineers. Conversely, the casting simulation is a new tool that has been assisting our company for a few years now in understanding the casting and solidification process. It has also assisted us to support our customers with the design of cast-ready components and safe processes.

Does casting preserve the environment? One would assume not because it consumes a lot of energy, produces smoke, and is loud. But I would like to counter – Yes, it does! Casting is the only process to produce near-net-shape components, which is the best way to save resources in production. If, in addition, secondary alloys can be used, this is even a type of recycling. Beyond that, in recent years we have invested substantial time and money in reducing our ecological footprint and in achieving transparency regarding our energy consumers.

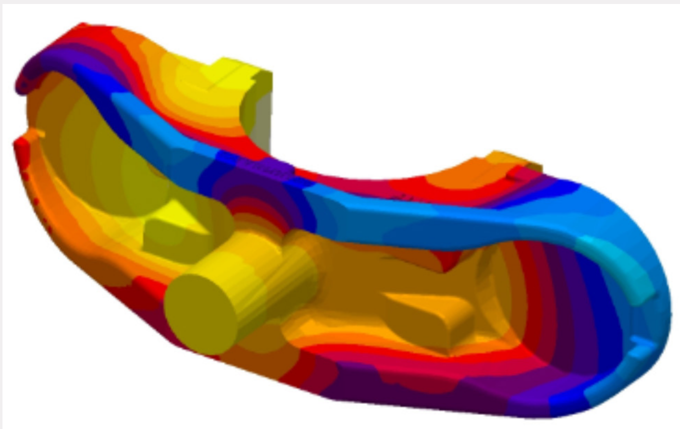
From Dietermann, our customers get full transparency concerning variable metal pricing. We will explain how this functions and why there is a so-called and an actual melting loss.

Enjoy the reading and stay tuned!
Your

Background: Digital Casting Tests
Mold filling and solidification simulation

For some years now, we have internally developed the capability and capacity to simulate our casting processes before the actual molding and casting. The entire casting process is depicted on a computer using very complex software. All influencing variables, such as the entire casting and gating system, feeder parameters and locations are designed and combined with process parameters, such as casting temperature or melt composition.

The location, speed, and temperature of nearly each grain of sand and each aluminum molecule are then calculated for the entire casting process and during the solidification process, from which a prediction is made about the casting quality. If the result is not satisfying, the next process alteration will follow. The calculation processes are so complex that the calculation time of just one single variation can take multiple days. As a result, we get a number of views, curves, and tables that have to be cleverly assessed; each individual depiction constitutes another statement, and this is where the work actually starts.



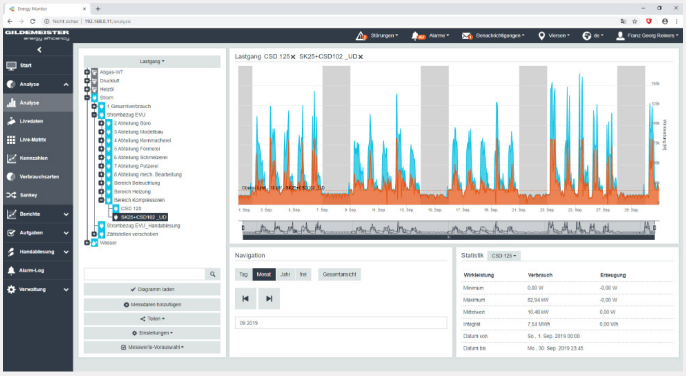
One might think that the software (we are currently using MAGMA) does the work for us. Rather, the results must be assessed and interpreted with solid process know-how and experience; What do the differences in the feeding module mean? Is there a real risk for cold run or not? Which melt speeds are permissible? Does the melt flow uniformly through the different ingates? What could the temperature distribution mean for material properties or hydrogen porosity, which cannot be simulated yet? These are just a few of the questions that the user has to answer. It is not the software that answers questions. Rather the software provides colorful images or videos, on the basis of which the actual value creation begins.

What is the point of all this? Indeed, we used to produce good and technologically advanced castings before. The simulation now allows us to set up the right process parameters more often right from the beginning when setting up new patterns. In fact, the number of improvement loops through all departments with pattern changes, sample castings and sample machining has significantly decreased. Furthermore, the simulation is intended to help us design more stable and robust processes in order to avoid future non-conformities by choosing the right process window: The production of a sophisticated aluminum casting implies the component-specific set-up of a few dozen different process parameters in a partially manual process. All of them interact and are frequently contradictory.

In addition to the set-up for the production of new components and the optimization of existing components, we also use the simulation ever more frequently in development projects, in which our customers include us as sparring partners. Using the simulation, we are able to demonstrate the optimization potential in relation to the casting quality or component costs and to assess the casting result of variations as "dry run".

Not everything that is colorful is correct – and thus the simulation has at times not corresponded to reality. However, overall the results present a very good prediction, and they improve our understanding of the casting process and, therefore, justify the expense.

Energy Management
Our ecological footprint



Without external pressure we have built up an energy monitoring system over the last two years that provides us with very precise data as to when which energy source is consumed at which location. Thus, we became re-familiarized with our company. We now know very well which machine consumes how much power, what percentage of the heating oil goes into room heating, what causes consumption peaks, what the many small compressed air leaks cost us, and where we have the largest lever to produce in a more environmentally-friendly manner.

In the process, we also encountered surprises - old technology can be similarly energy-efficient as new technology. Business decisions to implement investments for savings are often not justifiable purely on economic terms. Nevertheless, we took those decisions (most importantly: new compressed air supply, new shop-floor lighting, new transformers) with the conviction of wanting to contribute to resource preservation as an energy-intense company in Western Europe.

We now have transparency not only in our energy consumption, but also in production - workplaces have become even lighter while consuming just a third of the power needed previously for lighting.

In addition, since 2016 we have been operating an energy management system certified according to DIN EN ISO 50001.

Environmental Impacts
Reduced use of chemicals

In recent years, we replaced sand processing and core shooters in our core shop. In addition to expansion of our capacities and economical considerations, our focus was on reducing the use of chemicals for the sake of employees and the environment – dust is removed from the sand and high-precision pumps are used, thus we can run lower-dosed formulas for resins and hardeners. The gassing units work more accurately and more evenly, thus we can use less catalyst.

Come see us:
EUROGUSS on 01/14-16/2020

EUROGUSS

No distance is too long for us to visit our customers, and we are excited if you want to see on site where and how we work. As a third option for interaction, we will for the 2nd time exhibit at the EUROGUSS trade show in Nuremberg next year. We look forward to meeting you in hall 7A, booth 613!

Background II: Variable Metal Pricing
At Dietermann: always transparent

Metal prices fluctuate daily and are formed through supply and demand. If, for instance, a lot of metal scrap is shipped abroad, or if due to poor economic conditions little metal scrap is „produced“, at constant demand prices of secondary alloys will rise. Metal prices have a significant share in the cost calculation of foundries. To avoid economic woes, and to not have to constantly determine new daily prices, a surcharge calculation is common in the industry.

For this, a metal base price is agreed between customer and foundry, which demonstrates a share of the metal value that is already included in the unit base price. Some customers specify the metal base price. Specifying a metal base price in RFQs makes the purchaser's life easier in comparing item prices quoted by different suppliers. With a base metal price of 0.00 euros/pc., the unit price would show the pure costs of value creation. A frequently chosen basis is 1.53 euros/kg – this is derived from the formerly conventional basis of 3.00 DM/kg.

The fluctuating current metal prices can be found in third-party reference lists. Lists from „WVM“ (Trade Association for Metals) or from „Rheinfelden“ (supplier) are most frequently used. Direct stock market quotes (LME) are not suitable because they are derived speculatively and the conditions do not correspond to the prices during the physical acquisition of the metal. Costs in the supply chain, customs, intermediaries, and other things create markups.

The metal surcharge system works in both directions: Foundries conduct necessary adaptions to not incur any losses with rising metal prices. On the other hand, the customer profits when metal prices decline. Even negative surcharges are possible.

For the specific calculation, in a first step the block price difference is determined, which is the difference between included metal base price and current quotation.

Block price difference:

- Example: Raw component made of G-AlSi7Mg0.3 at a base price of 70.00 euros/pc. and net weight of 10.0 kg
- Contractually agreed metal base price = 1.53 euros/kg
- List value on a third-party price list, e.g. Rheinfelden = 2.60 euros/kg
- Block price difference here (2.60 - 1.53) = 1.07 euros/kg = 10.70 euros/pc.

In a second step, further costs dependent on the metal price are to be considered. They are summarized under the designation „melting loss" even if the actual melting loss (oxidation and vaporization during smelting) is only a part of this. Further costs dependent on the metal price include:

- Additional costs (melting, sawing, sorting) for the recycled material that is melted and cast, but then is cut off prior to selling the raw component
- Irretrievable metal loss due to processing, e.g. losses from burnup, casting, spilling, blasting, cutting, grinding, machining
- Reduced value of the reused, inferior recycled material due to contaminations and their large surface (ingate system, chips, dust)
- Material overhead for the interest calculation of the capital bound to the metal, loss of liquidity, costs for storage, and insurance
- Revenue-based special costs, e.g. commission rate, discount, and interest calculation of receivables

The „melting loss" factor of 20% established in practice corresponds relatively well to many calculations and internal records, while it must be higher for thin-walled components and copper alloys.

Continuation Example, adjustment for material price surcharge („MTZ"):

- Block price difference: 10.70 euros/pc.
- +20% „melting loss" on top of block price difference provides metal surcharge „MTZ" of 12.84 euros/pc.
- Actual price therefore = Base price + MTZ =
  = 70.00 euros + 12.84 euros
  = 82.84 euros/pc.

Dependent on arrangements between customer and us, this surcharge calculation is provided by us on a monthly or quarterly basis, either increasing or decreasing, but always in full transparency.

From Björn Schmidt, Sales

Insight: did you already know...

- **Tolerances:** consult our website for casting tolerances and machining allowances here.
- **Tolerances II:** do your drawings still contain tolerances according to the former DIN 1688? No problem, just consult our website for them, including a comparison to ISO 8062.
- **Mechanical properties:** an overview of mechanical properties for castings according to DIN EN 1706 can be found here.
- **Integration:** As we regularly and often successsfully employed and integrated staff previously long-term unemployed, we have won an official award from local authorities. Read more about this.