CASE STUDY

Innovative and Sustainable: A Foundry Steps into the Future with 3D Printing Technology

Eisengiesserei Mezger AG, a Swiss iron foundry, expanded its services with a highly automated 3D printing system from ExOne – making the jump into new markets

ExOne™

Dusty, dark and hot is how many people imagine the inside of a foundry. In the production halls at Eisengiesserei Mezger AG, however, visitors are met with an unusually clean workspace: An innovative 3D printing system from ExOne takes center stage in a new building. The Swiss company is now using cutting-edge 3D printing technology to produce its cores and molds. With its patented binder jetting technique, the 3D printer creates the sand products from a single piece and in a completely automated process. **This means that the tradition-steeped iron foundry is becoming a driver of innovation, and one which knows how to benefit from the advantages offered by 3D printing; namely greater flexibility in molding, lower costs and quicker production times for parts with complex structures.**

Production speed the decisive factor for entering into 3D printing

Eisengiesserei Mezger AG, founded in 1946, is now part of Camponovo Holding AG. Its headquarters are in Kallnach, Switzerland, around 30 km north-west of Bern. A total of 45 employees at the foundry produce around 2,500 metric tons of cast parts each year for customers primarily in the mechanical engineering sector. The foundry also supplies parts to customers in the gas and water supply sector, as well as in engine and tool manufacturing. “Our foundry focuses primarily on prototypes, limited-run series and replacement parts for national and international customers,” explained Silvio Camponovo, CEO. “Speed in production is the main factor here and one of the reasons we decided to use a 3D printer.”

Figure 1
Deslagging of the liquid cast iron

Figure 2
Pouring the mold in the machine formery

At the Gießereitag 2018 [conference for the foundry sector] in Salzburg, Mezger AG initiated contact with ExOne. “With ExOne, we had an expert partner at our side from the very first meeting – one which knows the foundry sector well and has an exact knowledge of everything that is required,” reported Dieter Diebold, Head of Sales and Foundry at Eisengiesserei Mezger AG. “From planning, all the way up to starting operations, ExOne provided us with expert support.”

CUSTOMER
Eisengiesserei Mezger AG

INDUSTRY / PRODUCTS
Iron foundry

HEADQUARTER
Kallnach, Switzerland

EMPLOYEES
45

SECTORS
Machine tools, railway, pump engineering, gas, water and district heating supply

WEBSITE
www.mezgergroup.com

Eisengiesserei Mezger AG

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Silvio Camponovo, CEO of Eisengiesserei Mezger AG

3D printing system is at the cutting edge of technology

An S-Max Pro 3D printer from ExOne, which was put into operation in June 2020, sits at the heart of the system; the solution uses the patented ExOne binder jetting printing procedure and was equipped with numerous additional features at the request of Mezger AG. ExOne offers these features as options within its modular portfolio, and they include the Fluidmatic material supply system, the Jobmatic automatic jobbox replacement function and a desanding station.

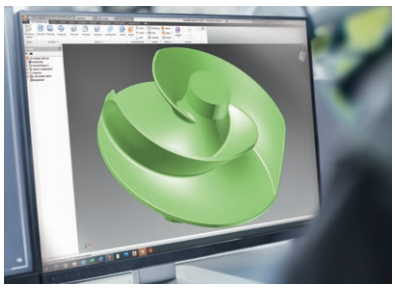
Figure 3
Plant operator in front of the S-Max Pro

Figure 4
Furan desanding station saves up to 50 % in time compared to manual desanding

Mezger AG prints cores and molds for iron casting in the foundry. Unlike traditionally manufactured core packages, which are often made up of multiple parts for complex molds, this process enables the number of molded parts to be reduced significantly, thereby reducing the amount of post-processing required. The more complex the shape of the molds and cores, the more apparent the benefits of 3D printing become. The size of the casts varies between 0.1 kg and 4,500 kg. "We previously procured our cores and molds from suppliers," said Diebold. "However, as our requirements continued to grow, and, as a reliable partner to our customers, we also wanted to be able to react to requests at short notice, we decided to take production into our own hands."

3D printing elevates Eisengiesserei Mezger to a technology partner

Thanks to 3D printing, Mezger can now support its clients along the entire value chain – from development, to engineering, all the way up to production. The expertise of the foundry is particularly useful when it comes to designing parts, as the customers are often unaware of the possibilities offered by 3D printing. The technology enables the foundry to be flexible when it comes to the design and realization of casting molds. It provides feedback on design plans and can quickly react to changes to the object through modifications to the CAD model. “The new possibilities that open up to foundries thanks to 3D printing mean that they are increasingly regarded as service providers and technology companies. Furthermore, the investments in innovative technologies are strengthening the trust of end customers in foundries,” explained Frank Betzler, Regional Sales Manager at ExOne.



From CAD model to 3D-printed mold

A CAD model is a 3D image that serves as the basis for the printed molds. It is transferred to the 3D printer on a USB, or via a network connection. The S-Max Pro at Mezger AG is equipped with two jobboxes and Jobmatic, a function that enables the jobboxes to automatically move into the 3D printer. On the base plate of the jobbox, the recoater in the printer first applies a thin, even layer of sand. In accordance with the CAD model, the printhead distributes the binder on the points which are to be joined together to make up the core. The binder, which at Mezger is furan, precisely surrounds each individual grain of sand. The base plate is then lowered minimally so that the recoater can apply a new layer of sand. These steps are repeated until sufficient layers of sand are adhered, and the mold is created layer by layer.

Once the printing process is complete, the jobbox automatically moves out of the printer. The number of parts manufactured during a single printing process depends on the size and shape of the parts. “For one of our customers in the pump sector, we produced an impeller / pump wheel,” said Diebold. “Up to 20 cores of this product can be printed in a single printing procedure. The entire process was therefore significantly quicker than the customer had initially expected.” The printing duration is dependent on the parts to be printed. In the best case, the foundry can produce a raw cast part within three working days using the S-Max Pro. If the entire printable volume of a jobbox – which has a volume of 1,260 liters – is used, approximately 1,800 kg of sand (FS003) is processed. Casting uses different qualities of gray cast iron or ductile iron, depending on the customer’s requirements.

Figure 5 (above)
CAD drawing of the 3D printing object

Figure 6 (center)
Desanding of the 3D printed core

Figure 7 (below)
Removing the downsprue / feeder from the casting

*"It was very important to us that ExOne supplied us with an almost **completely automated printing system.** Switzerland is a **country with high salaries**, so it is worthwhile to invest in automation technology."*

Silvio Camponovo, CEO of Eisengiesserei Mezger AG

Automation is a competitive advantage in a high-wage country

The level of automation inherent to the system installed at Mezger is especially high. "It was very important to us that ExOne supplied us with an almost completely automated printing system," explained Camponovo. "Switzerland is a country with high salaries, so it is worthwhile to invest in automation technology." As a systems supplier, ExOne combined the selected elements in line with Mezger's requirements, in order to achieve the highest possible level of automation in the 3D printing system. The system is equipped with a semi-automatic desanding station and the Fluidmatic system, which automatically fills the printer with binding, activating and cleaning agents. A 24-hour sand supply continuously provides molding material to the two jobboxes. The ExOne printer applies a layer of sand in 22 seconds, with the printing time alone for a completely full jobbox taking around 12 hours. This interplay between the individual automation components allows the system to operate for as long as 24 hours without the need for manual intervention. "The printer can run around the clock without any issues – in two-shift operation, with only one employee needed per shift," said Betzler. "We realize the level of automation according to customer wishes. From a high degree of automation, all the way down to predominantly manual operation, almost anything is possible."

Figure 8 (left)
ExOne 3D printer S-Max Pro Furan with two job boxes and numerous features

Figure 9 (right)
Supply unit for the 3D Printer, inkl. Fluidmatic, Sand Supply 24/7

And when it comes to recruiting staff, the cutting-edge equipment, which makes the company a pioneer in innovative manufacturing methods, represents a further advantage: On the one hand, the large investments show that Mezger AG has long-term plans to remain at its Kallnach site. On the other hand, the extensive system shows that the company has identified the potential held by 3D technology and knows how to use this technological progress to secure the future of the company. This entrepreneurial vision, combined with a pleasant working environment, appeals to specialist workers, young talents and apprentices, thereby compensating for the lack of specialized experts in the field.

"The content of recycled sand in a printing process is generally between 30 and 50 percent. Mezger AG determined the optimum mixing ratio for its products through several tests, and was able to increase the ***content of recycled sand to up to 80 percent,*** *while retaining the same process reliability."*

Frank Betzler, Regional Sales Manager at ExOne

Environmentally friendly use of resources

Mezger values a further special factor, as Diebold explains: "Alongside automation, it was of great importance to us that the production materials are used as sustainably as possible. The sand plays a large part in this," Diebold says. To minimize waste and disposal costs, the fresh sand is mixed with a certain proportion of recycled sand. Recycled sand is generated as a by-product during the printing process: Every layer of sand has to cover the complete base plate area in the jobbox, all the way up to the side walls, as the sand assumes a supporting function during the printing process. Just how much sand is glued with the binder depends on the shape of the parts to be printed. Once the printing process is complete, the base plate is lifted at the push of a button, enabling the unglued sand to flow into the funnels at the longitudinal sides of the jobbox. The sand is then fed into a recycling container, where it is extracted for the next job and mixed with fresh sand. "The content of recycled sand in a printing process is generally between 30 and 50 percent," explained Betzler. "Mezger AG determined the optimum mixing ratio for its products through several tests, and was able to increase the content of recycled sand to up to 80 percent, while retaining the same process reliability."

3D printing will tap into more markets in the future

In the first four months in which Mezger's system has been in operation, the initial response has been overwhelmingly positive: "Thanks to ExOne's support, the commissioning of the printer went absolutely smoothly," said Camponovo. "In the meantime, we have been able to observe various benefits in our production: We have been able to produce more quickly, and the printed cores have impressed us with their high quality, as well as the flexibility in design options."

The expansion of the service portfolio, the development of new business areas and the growing diversity of products are all indicators that the investment costs will be amortized over the next few years. At the moment, Mezger is using the S-Max Pro primarily for small series production, for replacement parts and for prototypes; however, the Swiss company expects the numbers of parts produced to grow in the future. 3D printers are particularly well suited for complex shapes with undercuts, especially when they are as highly automated as the system at Mezger. "We expect 3D printing in foundries to play an even larger role in the future," said Camponovo. "We are already thinking about investing in another 3D printing system if orders continue to rise."

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