



CASE STUDY

Fit-For-Purpose Engineering Solutions with Sand 3D Printing

Binder jetting delivers quick-turn,
first-pour success castings at
Demir Engineering



"We use the S-Max as our full tooling factor. We had a CNC router to build wood conventional tooling, but we've actually packed that up since bringing in binder jetting."

Matt Carver, Business Development Manager, Demir Engineering

Engineering solutions for severe conditions

Canada's largest energy region sits at the heart of the Province of Alberta and is one of the world's most active locations for chemical, petrochemical, oil, and gas investments. The surrounding industrial heartland attracts globally-competitive industrial services such as pipeline design and fabrication, rigging, and heavy construction.

To support the demand for maintenance and wear parts from these large industries, Demir Engineering, a materials solutions and engineering service provider in Edmonton, made a major equipment investment of its own, including an ExOne S-Max Pro binder jetting system – the first large-format sand 3D printer to offer outsourced production services in Canada.

With a core focus on engineering materials for severe conditions, the company's modern business model focuses heavily on digital processes. "We put in the engineering work up front with customers," said Matt Carver, Business Development Manager at Demir. "Our team supports design, modeling, and simulation in order to allow clients to use a just-in-time inventory strategy."

With the importance of uptimes for the surrounding energy sector – where downtime often costs production tens of thousands of dollars per hour – the speed of binder jet 3D printing on the S-Max allows Demir to service the quick-turn casting market.

Printing directly from a CAD model, Demir eliminates the production time of traditional patterns and core boxes. "We use the S-Max as our full tooling factor," Carver said,

CUSTOMER

Demir Engineering Ltd.

LOCATION

Edmonton, Alberta

INDUSTRY

Material and metallurgical engineering

APPLICATIONS

Quick-turn castings, from replacement parts to rapid prototypes

3D PRINTER

ExOne S-Max® Pro

3D PRINTING MEDIA

Silica sand, furan binder

WEBSITE

www.demirengineering.com



The S-Max Pro is used to print molds and cores for quick-turn castings at Demir Engineering, eliminating the time and cost of traditional tooling both prototype and legacy and replacement parts.

explaining how the company offers fast turnarounds with digital production. “We had a CNC router to build wood conventional tooling, but we’ve actually packed that up since bringing in binder jetting.”

Castings traditionally rely on a patternmaker trained to understand all the calculations to design gating systems and the size of risers to ensure success of the metal pour. However, digital calculations, simulations, and design freedoms are bringing new efficiencies to improve the process.

For replacement parts without an existing pattern to build a casting mold from, Demir uses 3D scanning technology to build a digital file before running models to simulate pouring parameters and solidification. This engineering work ensures first-pour success for these mission-critical castings.

“If the simulation says that we’re going to have a hole somewhere in the casting, there’s a good chance we’ll have a hole there,” explained Adam Ostashek, Engineering Manager at Demir. “We try to avoid that by iterating as much as we can in the software. Once we see something that’s quite sound, we print the tooling, cast it, and it comes out pretty much exactly as we calculated.”

Eliminating the need for hard tooling and the production speeds of binder jet 3D printing mean once a design is finalized and sent to the S-Max machine, the mold

package and complex cores can be ready for casting at Demir the very next day.

Binder jetting the tooling layer-by-layer also enables the team to design unconventional gating and mold rigging with ease that can improve casting success. “The geometric possibilities are a lot more free with sand 3D printing, so we can print gating and riser systems that you could never make before, or that you could make, but it would be quite painstaking,” Ostashek said.

The digital workflow of binder jetting is helping the company unlock the possibilities of its advanced engineering capabilities and grow its business. Growth so rapid, that less than a year after installation of the S-Max machine the company is already adding a second job box to expand capacity.

After front-end simulation to ensure final quality of the pour, mold packages are printed and ready for casting in as little as 24 hours.

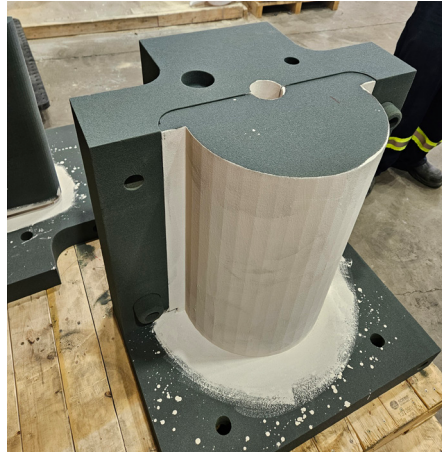


Five-day turnaround puts a halt to expensive downtime

A mining customer of Demir recently required a coupling to replace one that had failed in service. The OEM quoted a five-to-six-month turnaround time for a replacement part. With an estimated downtime cost of \$40,000 per hour, the mining company turned to Demir for a rapid replacement. After reverse engineering the part from a 3D scan, the team simulated the pour, printed the mold on the S-Max, and sent the brass casting out to be finished machined a mere five days later.



Mold packages are 3D printed in sand from a digital file, removed from the job box, assembled and prepped for casting without traditional tooling or core boxes.



Alberta's industrial heartland is also an intersection of energy development, innovation, and environmental leadership, so supporting regional operations with quality castings isn't only about avoiding the economic cost of downtime. Producing local quality castings reduces lead times while also reducing the carbon footprint of the overall production process.

"That's where I get excited being a business development manager," Carver explained. "We can produce these parts in North America rather than making them overseas, plus scrap reduction from our engineering and all these benefits from our process that support green initiatives and circularity brought back into North American production."

Producing from design files also allows Demir to service a variety of clients with custom jobs without carrying stock – instead supporting digital inventories and on-demand manufacturing initiatives that look to take a greener approach to production.

The mining sector plays an important role in Alberta, and downtime can quickly cost companies hundreds of thousands of dollars. When a coupling failed, costing a mining company \$40,000 per hour, it turned to Demir to reverse engineer a part from a 3D scan. Compared to the OEM quote of up to six months for a replacement part, Demir scanned the part, simulated the pour, 3D printed the mold package on the S-Max, and cast the brass coupling within five days.



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Adam Ostashek, Engineering Manager, Demir Engineering



Growing with flexibility

Although Demir initially invested in binder jetting to service the regional maintenance market, the flexibility of the technology means the variety of business growth opportunities continues to expand.

The majority of its customers today value the fast turnarounds, with an increasing number taking advantage of the ability to create replacement parts from a digital inventory. Other clients value the ability to create complex applications without the manufacturability constraints of traditional tooling processes, like impellers and volute pumps.

Another client segment values the ability to test new designs before investing in production tooling. “Our core service is engineering for severe conditions,” Carver explained. “And because we engineer material solutions, clients naturally want to prototype them, try one before they move to mass production.”



He explained how the flexibility of the S-Max is vital to this success. “We’re not set in a path right now. We’re really just solution providers.”

Engineering Manager Ostashek agreed, explaining how the team is experimenting with new projects like molds for glass manufacturing or for rubber to be cast into steel, as well as optimizations to make everyday production even faster. He even described project inquiries from direct metal 3D printing applications. “Casting proved to be a better fit because our large size and footprint allows a lot more single or double pieces rather than them building components in multiple smaller pieces that need to subsequently be joined, but we still have the design freedom of additive,” he said.

Demir continues to grow with the growing demand for quality engineering services with flexible production solutions. “We’re seeing lots of business,” Ostashek emphasized. “We’re printing basically every day. We’re pouring almost every day.”

With the second job box recently installed the company is meeting current demand, but already clearing floorspace to add a second machine to keep up with projected growth.

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Adam Ostashek, Engineering Manager, Demir Engineering

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ABOUT DEMIR

Demir Engineering Ltd. is a material and metallurgical engineering company focused on integrating the next generation of metals, alloys, and advanced materials for clients' products. Demir delivers a wide range of products, solutions, and design services to various industries. Our team brings together decades of diverse experience to deliver fit-for-purpose engineering solutions to our clients. We strongly believe that our success is guided by our vision and commitments to Integrity, Innovation, Confident Delivery, and Valuing People.

ABOUT EXONE

ExOne is now part of Desktop Metal's group of #TeamDM brands, which exist to make Additive Manufacturing 2.0 a reality so we can unlock the vast benefits of 3D printing at meaningful production volumes. Our 3D printing systems quickly transform powder materials – including metals, ceramics, composites and sand – into precision parts, metalcasting molds and cores, and innovative tooling solutions. Industrial customers use our technology to save time and money, reduce waste, improve their manufacturing flexibility, and deliver designs and products that were once impossible. As home to the world's leading team of sand binder jetting experts, ExOne also provides specialized 3D printing services, engineering, and design consulting.

