



CASE STUDY

Obsolete Replacement Part Delivered in Two Weeks with Digital Casting

Speed 3D Mold uses ExOne binder jetting to provide a replacement casting for a legacy diesel engine cylinder head without tooling



Speed 3D Mold is a sand moulds & cores manufacturing, premium replacement part, and prototype casting company supporting processes for manufacturers in Thailand. They work with customers in a strong partnership to improve the process of the casting product, either simple or complex castings with no boundary on design for impellers, prototypes for pumps, automotive, marine, heavy industry, and the tool and die industry.

Marine engines operate in harsh environments with constant exposure to humidity and water, often salt water, that will deteriorate engine components. Because diesel engines create combustion from high cylinder pressure and heat, they must run at high compression ratios in order to generate enough heat to auto-ignite the diesel fuel.

Cylinder heads are critical components in the engine that support other important parts such as the fuel injectors and inlet and exhaust valves. Located on top of the liner flange and secured to the cylinder block with nuts and bolts, they are exposed to extremely high temperatures and pressures, expanding and contracting as the engine rapidly heats and as it cools. Because of these environmental conditions, marine diesel engines must be built to withstand the extreme pressures involved with high cooling requirements.

Hi-Tech Marine Engineering, a shipyard in Thailand, was faced with a cylinder head with cracks caused by the large amount of stress from overheating. With a business that operates every day of the week, the cargo boat needed a fast repair to return to service, yet the broken component was nearly a decade old and no longer in production from the OEM supplier. "Time to delivery is critical in our business - we cannot wait for parts because we are in constant operation, so we need fast turnarounds on-budget," said Aomthep CheinSuwan, Owner of Hi-Tech Marine.



A replacement for this cracked cylinder head was needed to return a cargo boat to service, but no casting pattern existed

CUSTOMER

Speed 3D Mold Co. Ltd

LOCATION

Samutsakorn, Thailand

INDUSTRY

Maritime, pump, heavy machinery, automotive, tool and die casting

APPLICATION

Replacement cylinder head on a diesel marine engine

3D PRINTERS

S-Max®

MATERIALS

Silica sand with furan binder

Cast material:

ASTM A48 class 30 Gray Cast Iron

WEBSITE

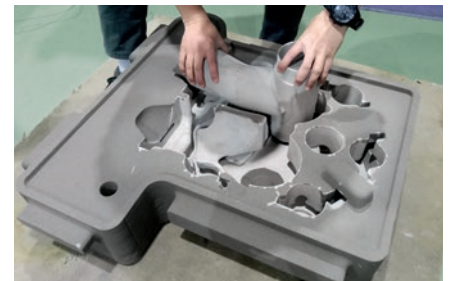
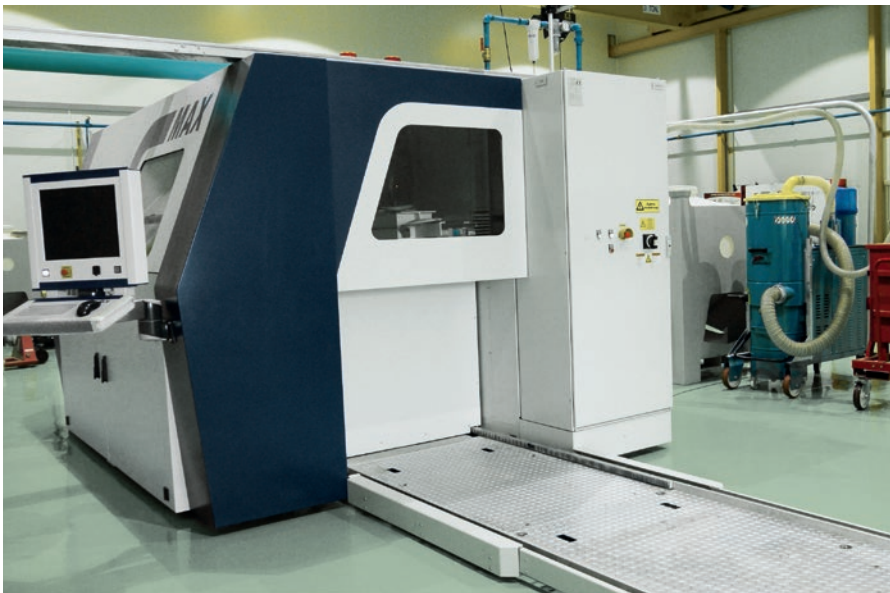
www.speed3dmold.com

*“For our customers in the maritime industry where there are many legacy parts that need replacement, **speed is the most important factor** for timely maintenance to keep systems in service.”*

Nattinee Valun-araya, Head of Engineering, Speed 3D Mold



A traditional replacement part had a lead time of over 10 months and would come at a very high investment cost. Because the cylinder head is a legacy part without tooling, an entirely new pattern and core box set would have to be manufactured first to produce the replacement casting. Yet Hi-Tech Marine required a replacement part within four weeks any overseas order would require at least eight weeks with increased costs for shipping.



Speed 3D Mold used its S-Max® sand 3D printer to create a pattern and core box set from a CAD file without tooling

Speed 3D Mold, a casting and prototype development shop located in Thailand had the solution to offer a high-quality replacement part, supplied with a fast turnaround and locally, without logistical issues. “For our customers in the maritime industry where there are many legacy parts that need replacement, speed is the most important factor for timely maintenance to keep systems in service,” said Nattinee Valun-araya, Head of Engineering at Speed 3D Mold.

With over a decade of experience providing casting simulation support, sand 3D printing, and prototype and replacement casting, Speed 3D Mold’s engineering department supported Hi-Tech Marine with reverse engineering services. The team 3D scanned the original part to create a digital CAD file that could be used to develop a 3D printed mold and core package for casting a new component. With binder jet 3D printing no hard tooling is needed to create the replacement casting, rather the mold and cores are built layer by layer in sand directly from the CAD file.

With digital casting, Speed 3D Mold was also able to make fast iterations to the part to ensure the optimal quality for Hi-Tech Marine’s replacement cylinder head. The part contained many complex features, including large thickness differences and small

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cooling channels, yet could be easily modified with the digital casting process. The design freedom of additive manufacturing also allowed Speed 3D Mold to update the design of the cooling channel as well as freely place the rigging system within the mold without the traditional limitations to casting design.

The complex 725 × 630 × 572 mm mold package contained 19 pieces 3D printed on the S-Max® binder jetting system in just 10 hours with no unexpected errors in dimension or shape.



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A traditional replacement casting carried a 10 month lead time for tooling — this replacement was produced with sand 3D printing and delivered in weeks

The nearly 100 kg replacement cylinder head was cast in gray iron and the final component was delivered to Hi-Tech Marine in just two weeks. The large capital investment to make tooling for just one replacement part would not have been economical, but Speed 3D Mold’s solution to directly print the mold package with ExOne sand binder jetting can save 40 % compared to conventional production.

“Our customers depend on us to deliver premium quality. The quality of the cylinder head can improve the efficiency of the engine in operation, so we’re able to offer value-add with fast delivery, reduced costs, and precision tolerances for maximized performance,” Valun-araya summarized.

