Casting Central to Hydrant Revolution

OEM startup Sigelock is out to change the way fire hydrants are designed and operated, and a metal casting is helping make it happen.

Shea Gibbs, *Senior Editor*

George Sigelakis makes sure he is heard. In a recent eight-person conference call about his business, his voice was the loudest.

So when Sigelakis, a veteran New York City firefighter, decided more than a decade and a half ago he wanted to reinvent the fire hydrant, it's no wonder people listened.

Today, Sigelakis and his team, Sigelock Systems LLC, New York, are on the precipice of what they believe will be a total paradigm shift in the way the world buys hydrants.

"I've said to everyone, we are going from the Neanderthal to the modern man," Sigelakis said. "It's the horse and buggy to the modern day race car. It's a whole new animal in hydrants."

If he's right, Sigelock is going to buy a lot of castings over the next few years. Central to the success of the new design is a 140-lb. cast ductile iron hydrant body that houses the rest of the assembly in its 24 x 14 x 14-in. envelope. According to Sigelakis,

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the clamshell-shaped body gives the hydrant its main advantage over other hydrants on the market.

"I grew up on Rockaway Beach, right by the ocean," Sigelakis said. "I was always intrigued by the way the clam locks itself. It can't be pried into. "

In the new Sigelock hydrant, the ductile iron casting is the clamshell, and it too is expected to be impenetrable.

A Clam's Home

According to Sigelakis, the traditional fire hydrant has been made the same way for 100 years, and it's highly vulnerable to tampering. The cliché image of urban kids playing in water from the neighborhood hydrant is no myth, he said, and when people open the devices to enjoy their cool spray or wash their cars, it damages them. That can cost lives.

"When hydrants break down, firefighters have to go to the next hydrant," Sigelakis said. "And every second after 2.5 minutes, the fire doubles in size, increasing the risk of backdrafts and people dying."

To greatly reduce the risk of unnecessary deaths, Sigelakis first redesigned the traditional hydrant with a built-in locking mechanism. Next, he needed a way to protect the new lock. The high strength ductile iron clamshell design turned out to be ideal, keeping scofflaws from prying into it and deflecting blows from blunt objects like sledge hammers.

"The casting is the body of the hydrant and the protection of the operating parts. It is a key part," Sigelakis said. "A regular fire hydrant is like a faucet. It's just a pipe coming out of the ground. The operating nut sticks out and is exposed."

Sigelock calls its new hydrant the Spartan, and the company said the overall effect of the new, enclosed design is to make the municipal waterworks equipment safer, more reliable, less risky for property and civilians and greener, wasting less water than traditional hydrants. In addition to deterring vandals, the company says the Spartan is more resistant to weather corrosion and requires less

Sigelock's Spartan hydrant was first installed in Pennsylvania. The company expects to sell 10,000 of the units in the first two years of production.

The ductile iron casting at left is the main structural element of the Spartan hydrant, enclosing and protecting its working parts.

maintenance than its predecessors.

"We've achieved standards for the certification of hydrants that have never before been done," Sigelakis said. "Because of the design and the casting quality, we are able to reach 300 psi working pressure on a hydrant, higher pressures than [any other hydrant]."

Casting Call

The Sigelock team expects to sell a lot of fire hydrants. According to Chris Blaise, Sigelock's senior operations consultant, a conservative estimate of the number of hydrants the company will sell in the first two years of production will be 10,000. More aggressive estimates go further: more than 40 million hydrants are operating in the U.S. today, and most municipalities and water authorities will replace more than 1% of hydrants each year. That's before the foreign market is tapped.

"We could easily exceed that number," Blaise said. "We opened a new market that never existed. [The traditional hydrant was] designed for a high maintenance situation. Ours requires minimal to no maintenance. We never have to look back."

So, volume was a central concern when Sigelock began sourcing the casting it would need to make the paradigm shift happen. Its starting point was 500 units per day of available capacity. Sigelock furthermore wanted to utilize only domestic suppliers—the numerous high volume casters operating in low-cost countries were off limits, due to both a desire to maintain a "made in America" status and to avoid quality concerns.

"Let's say a company in China said they could do it a little cheaper. I wouldn't consider it," Sigelakis said. "To me, it was very important to stay in the U.S.A."

A review of the domestic landscape revealed few suppliers in the country that could meet the company's needs. Some of those said the shape of the casting was too difficult to work with. To solve the sourcing dilemma, Sigelock turned to one of the largest iron metalcasters in the world—ThyssenKrupp Waupaca Inc., Waupaca, Wis. The company operates vertical green sand molding machines, the fastest of the sand casting platforms, while also offering large flask sizes, uniform products from run to run, tight dimensional tolerances and smooth surface finishes. Waupaca's Tell City, Ind., facility had the capacity available to take on Sigelock's volumes and then some, offering the ability to produce more than 100 castings per hour—not just 500 per day.

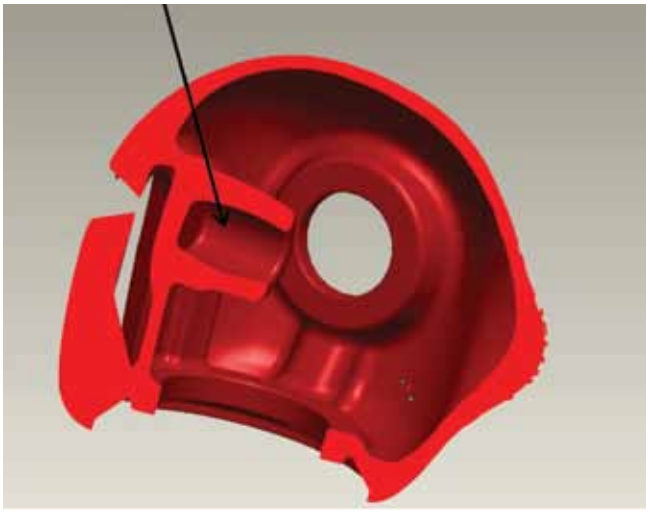
"We researched Waupaca because its technology was available at a reasonable cost," Blaise said. "Due to the weight and size of the casting, it was an easy decision. With the cost efficiency combined with the volume, there was no need to consider other methods than vertical green sand molding."

The Evolution of an Idea

The body casting of the Spartan hydrant is more than just a clamshell. It includes complex interior passageways that scared off several potential casting suppliers early in the 15 years of research and development Sigelakis has put into the hydrant. When the Sigelock engineers delivered their original design to Waupaca, the response was different.

"The working relationship was great from the first day I met [Sigelakis]," said Shelby Applegate, Waupaca's lead engineer on the project.

According to Applegate, the Sigelock team was willing to alter



Because simulation software predicted a large section of porosity in the solid section at the top of the hydrant, a hole was added to aid in solidification, as indicated by the arrow at right.

the design in whatever way was necessary to achieve a part that was castable at a reasonable cost. While the original design required a five-piece core assembly, the team was able to whittle that down to two. The reduction was instrumental in achieving a 37% price break from the original design.

One of the critical elements of the redesign and reduction of cores was a change in the drainage valve originally situated at the bottom rear of the casting. During rain storms or other precipitation events, hydrants can collect water, which needs to be released from the body. The drain hole originally put in place by Sigelakis and his team was not in an ideal spot to be cast. According to Applegate, the 0.5-0.625-in. hole had to be removed to achieve the simpler core package.

"We originally had a drain hole in the rear," Sigelakis said. "We eliminated the drain hole and instead created two channels under the tongue [to allow drainage]. Additionally,

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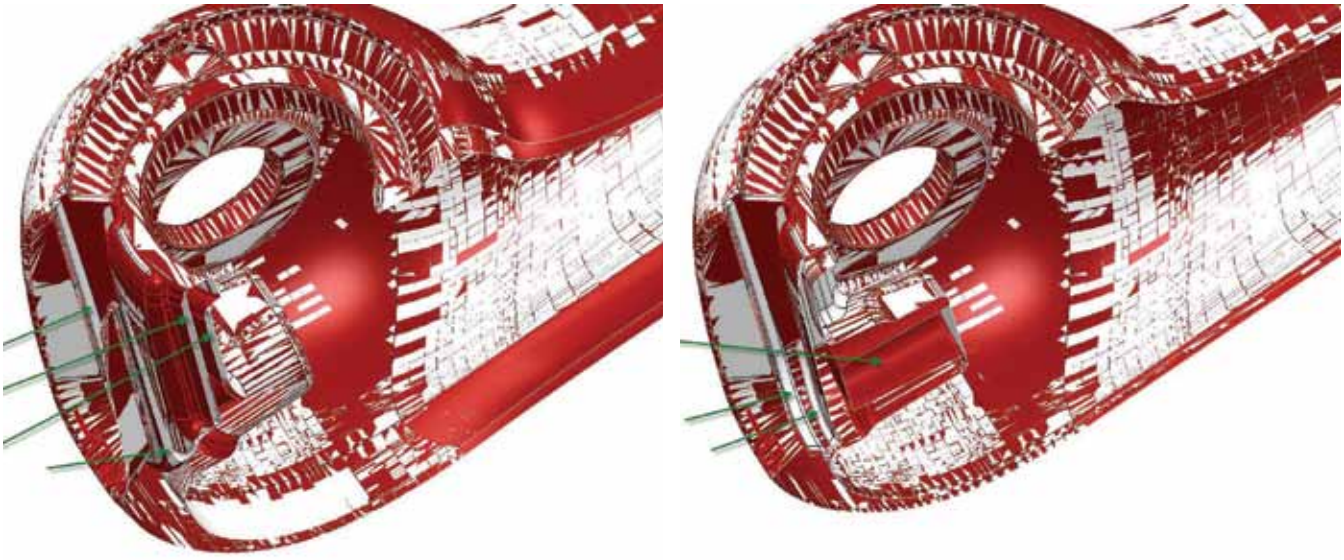

Here, the design changes at the top of the casting are shown with the red model representing the original drawing and the white model being the new design. The arrows indicate areas of the cross-section where changes were made.

it also protects the tongue and helps hold the core in place."

Applegate said several other changes completed the reduction in the number of cores used, including a change in the draft on the front cap at the top of the hydrant so that the cores could be drawn naturally (i.e., removed from the sand mold without damaging it). On the interior of the casting, the engineering team cored the hole where the ball screw would go to reduce porosity. Finally, mass was removed from the inside channels so those cores could be drawn naturally, as well.

"The cost of the tooling was much less after the redesign," Sigelakis said. "Much, much less."

The new core design also eliminated a significant number of man-hours at the casting facility, contributing to the price reduction. To further curb costs, the design team was able to trim wall thicknesses across the entire hydrant body. While the original design had many transitions between thick and thin sections, the final design offered uniform wall thicknesses throughout.

"We reduced wall thicknesses to bring the mass down and achieve better castability for reduced scrap," Applegate said. "The redesign removed heavy sections that would have caused shrink, aided in solidification and reduced mass by 11%."

The only thing left to set off the hydrant revolution envisioned by Sigelakis is selling his product to municipalities—at home and abroad.

"From day one when we told Sigelock we could do this, they said we can go to the moon with this," said Mark Koziorowski, sales manager for ThyssenKrupp's off highway group, who handles the Sigelock account. "And we are just about ready to light the fuse on this rocket." ***Metal***

George Sigelakis, inventor of the Spartan hydrant and veteran New York City firefighter, believes the design will save lives.