



P&H Mines Casting Prospects

For P&H Mining Equipment, in-house fabrications are a necessity. But sometimes they're not the most efficient way to do the job.

Shea Gibbs, Senior Editor

Robert Mueller Jr. thinks he can save his company some money. He's spotted a component that looks like a good candidate for casting conversion, and he's running with it.

Mueller holds a unique position at P&H Mining Equipment, Milwaukee. Officially the "casting procurement specialist," Mueller does all the casting purchasing for an organization that sold 28 multi-million-dollar pieces of equipment last year. In addition to working with the casting supply base (and putting each metalcaster through a rigorous vetting process), Mueller is also the go-to guy for casting designs at the mining equipment OEM.

With 23 years of experience in the metalcasting industry prior to making the switch over to the purchasing side, Mueller knows when he sees a casting—whether it has been produced via the metalcasting process or not. He looks at the steel fabrications used in P&H's portfolio of heavy equipment and decides whether casting might be a more economical way of making one of them.

In the most recent case, he has spotted a portion of the boom on one of P&H's massive above ground mining shovels. He's already drawn up the concepts for the part, cleared the replacement of the fabrication with internal engineers and is reaching the end of the conversion process. But there's still work to be done.

"I have been pitching for a long time to get this converted into a steel casting, and now I have finally gotten it provisionally approved," he said. "Right now, I'm working with one of our top suppliers and a local pattern shop. Then, I'll meet with our engineering people, provide them with the

costs of the metal casting, do a cost comparison with the fabrication and see if it's a winner."

The Family Tree

P&H is one of several companies that fall under the umbrella of parent company Joy Global. While P&H handles the above ground mining equipment, Joy Mining Machinery makes equipment for underground mining. Joy also owns Continental Conveyor, a maker of mine material transport products, and MinePro, which provides onsite mining machinery maintenance and support. P&H employs between 950 and 1,000 in the manufacture of a variety of above ground mining units, including blast-hole drills and drag-lines, but its line of electric shovels is the heart of the company.

From smallest to largest, the company offers the 2800 and 4100 shovels, each with several different versions, as well as supporting older models. The units essentially consist of a treaded locomotion device at the base, a cab and counterweight at the center, and a boom and shovel extending out from

the cab, all powered by electric motors that never need to stop for refueling at the jobsite. The mining equipment uses a variety of castings in all of the above locations; the company buys between \$60 million and \$70 million worth of castings per year. About 90% of that dollar value goes to large steel castings produced primarily in the nobake process, and the balance is comprised of iron counterweights and smaller aluminum, brass and bronze castings that go into the electric motors that power the mining shovels. But the company also uses a number of homemade fabrications, and it is one of these components that is of the most interest to Mueller right now.

At the base of the boom that connects to the revolving frame of P&H's mining shovels, several metal plates come together to form an attachment point. The resulting fabrication is the equivalent of an industrial-size 6,000-lb. needle's eye. Two plates form the bookends of the component, with the inside plate bent just below the base of the eye. Several other plates form the meat of the structure, and each has a hole cut out of its center. That's a lot of processing for one fabrication, according to Mueller.

"I look for lots of plates, with a lot of internal processing to that plate," Mueller said.

Spotting a Casting

Mueller has to prove his worth during at least two stages in the casting conversion process—working together with the pattern shop and metalcaster and then taking the fruits of their labor to P&H's engineers. And while this latter stage is the most crucial to the success of the conversion, it's also an expensive proposition. So Mueller must be right about the prospects of the

P&H Mining Equipment Milwaukee, Wisconsin

Employees:	950-1,000.
Castings Purchased:	\$60 million to \$70 million per year.
Casting Weights Purchased:	Ounces to 51,000 lbs.
Casting Applications Purchased:	Large steel castings, manganese steel crawler shoes, iron counterweights, small nonferrous components.
Facility Size:	46 acres.



P&H makes its equipment in pieces and ships it to mine sites, where another affiliate of its parent company, Joy Global, performs the assembly. The boom eye that the company is currently targeting for casting conversion is at the left end of this boom.

conversion before he ever gets started.

Essentially, Mueller looks for fabrications that have a lot of the characteristics of the boom eye. Any part with a large number of welded plates, each of which requires a variety of processing steps, makes a good candidate. The processing steps Mueller looks for are bending, heat treating, weld beveling, machining and cut-outs, or parts that create a lot of what he calls “drop.”

To make plates for a fabrication, P&H takes a large slab of metal (it can be anywhere from 2 to 10 in. thick) and sets it under a laser cutter. The cutter then follows a computer-controlled path to cut out the desired shape. The pieces of metal that fall out of the plate are known as drop, and those pieces are scrapped. The resulting metal plate shapes are then pre-processed, welded together and

post-processed, leaving the desired metal component. All of those steps are performed by P&H at its 46-acre manufacturing facility in Milwaukee.

So, if a part with several plates requiring several internal processing steps can be produced by an outside metalcaster at a reduced cost and lead time, Mueller has done his job. But again, the most crucial part of the conversion process

is yet to come after the identification has been made.

Following Through

Mueller's experience in the metalcasting industry has given him the perfect skill set for his job. He speaks the language of each of the parties involved in each step of pulling off a successful conversion from fabrication.

First, Mueller has a cursory discussion with P&H's inside engineers. Sometimes, this can be the end of the line for a casting conversion. If the piece can't be forced to mate properly with the overall piece of equipment as a casting, it must remain a fabrication. Mueller works with the OEM engineer to determine if the casting can be bolted or welded to the overall structure, for example.

Next, he hammers out the details of the conversion, with an eye to-

“To find casting conversion candidates, I look for lots of plates, with a lot of internal processing to each plate.”

**—Robert Mueller Jr.,
casting procurement specialist**



This fabricated boom eye (shown before assembly in the inset) is P&H's current target for conversion to casting. To produce the fabrication, P&H must process multiple steel plates and weld them together.

ward both what will work on the designated piece of equipment and what can be cast. For the current conversion, for example, the shape of the casting had

to be slightly altered from the original fabrication to make it compatible with the boom to which it would be attached. While the fabrication extends back from

the base of the boom eye for three or four feet and includes a hollow cutout, the casting will have to terminate several inches below the bend. The casting

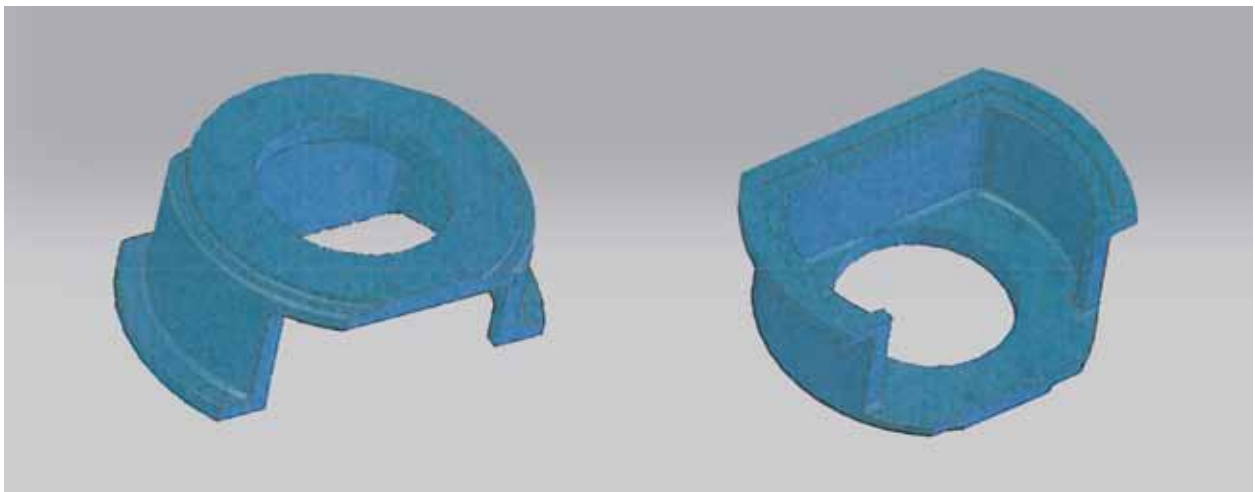
Completing a Motor Mount Conversion

While the boom eye only has been provisionally approved, P&H Mining Equipment recently completed and has implemented the conversion of a swing motor mount for its electric mining shovels.

The part provides a mount for the electric motor driving one of three swing transmissions, which allow the shovels to move from left to right. The 1,104.39-lb. casting measures 28.06 x 41.38 x 15 in. and supports a 2,313 horsepower motor.

The steel part was cast by Spokane Industries, Spo-

kane, Wash., in nobake sand. It offered P&H a per unit savings of 55% over the previously fabricated part and reduced the machining time by 50% by casting in raised machine pads. The part, which offered increased strength, was co-designed by the metalcaster and the customer, and the first article samples were delivered 16 weeks after conception. Because the casting was done by an outside source, it also afforded P&H additional capacity through the removal of fabrication and heat treat operations. **MC**



The conversion of this swing motor mount (shown as an electronic rendering) took 16 weeks from conception to first article sample delivery.

still will eliminate the need to process the bend in the plate, but it also will retain the integrity required for the component to function properly.

Mueller then draws up the blueprints for the proposed casting. Working from the fabrication prints, he overlays the specifications of the casting with the proposed changes. This part of the design process requires considerable back and forth with the pattern-maker and metalcaster, and casting suppliers and pattern shops with engineering expertise have a leg up on other suppliers for this reason. The team must make the component castable, model the component and perform a solidification simulation before completing the final pattern construction.

Once he has the model in hand, Mueller heads back to the P&H engineers to do the cost comparison, and he usually has a pretty good idea what the outcome of that will be.

"Once it gets to that stage, there's a

Digging Up Good Casters

Robert Mueller Jr., P&H Mining Equipment's casting procurement specialist, credits good casting suppliers for turning around the reputation of metal castings at his company. For a new supplier to pass muster, it must exhibit:

Quality—P&H expects to have an internal rejection rate below 2%.

On-Time Delivery—P&H aims for above 90% on-time shipments.

Management—The casting management team must know what's happening on its shop floor.

Quality—The casting source should have a quality assurance team that pays close attention to melt, sand and heat treating process controls.

Value-Added—If a company can offer engineering expertise, they have a leg up on the competition.

Integrity—If a caster works with pirates or acts as a pirate itself, it is blacklisted.

MC

pretty good chance it's going to be a winner," he said.

Whether It's a Winner...

Twenty-three years in the metal-casting industry by no means ensures success with every casting conversion Mueller tries to perform for P&H. But he is confident that after seven years with the company, the perception of castings has improved to the point that he is in no danger of losing his job.

"Before I got here, castings had a black eye due to delivery and quality issues," he said. "Price wasn't the biggest driver. Quality and on-time delivery were the first thing we had to improve."

Mueller doesn't take all the credit for improving the reputation of cast components at P&H. Mostly, it was a matter of finding the right casting suppliers to prove to management they could do the job. Today, the company has between 1.2% and 2% rejections on cast components, and its suppli-

ers generally exceed 90% on-time delivery.

P&H currently has about 30 casting suppliers. They're mostly domestic, but Mueller also has had to vet several foreign sources. When it comes to finding the right metalcasters, Mueller says he looks at the administration first.

"I look for a group with a management team that has its finger on the button all the time," he said. "[A management team that] sits up in the office is not going to help me."

He also looks for a conscientious quality team that keeps a close eye on its sand, metal and heat treating processes.

Even with all of those traits, one intangible characteristic can blacklist a potential casting supplier from P&H's list—integrity. Because the company relies heavily on aftermarket part sales for the maintenance of its equipment, if a caster works with pirates (makers of knock-off P&H parts), their days as a P&H supplier are over.

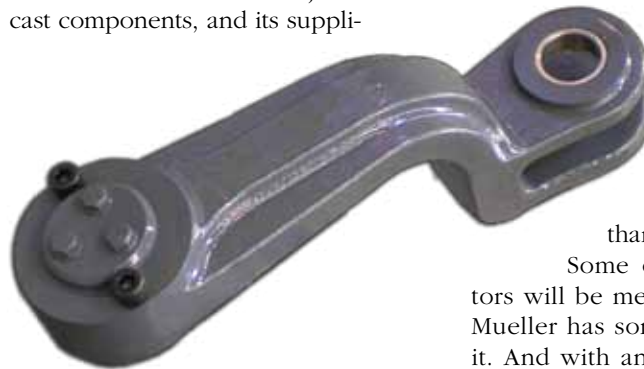
"We have a confidentiality agreement we have suppliers sign," Mueller said. "If you're going to be a supplier to us, you're going to be dedicated."

Going forward, P&H will need such dedicated suppliers. According to Mueller, the mining industry is suffering through the current recession as much as any, and particularly with 2008 being a record year in terms of electric shovel sales, P&H is counting on a down 2009. But according to Mueller, it should be equipped to handle the downturn.

"During the big boom in the last couple years, sales went through the roof," he said. "We had a difficult time keeping up. But we used our existing footprint and employed subcontractors [rather than expanding]."

Some of those subcontractors will be metalcasters, as long as Mueller has something to say about it. And with any luck, one of those metalcasters soon will be making a re-engineered boom eye that was once a fabrication.

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This snubber arm casting replaced a steel fabrication and keeps the 25,000-lb. dipper door on P&H's electric mining shovels from opening and closing too fast.