Midwest Metal Products

Case Study W2C-019

Topic: Weldment-to-Casting Conversions

What is the process for converting a weldment to a casting?

Type Report: Background/Education
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Summary

What exactly is a weldment-to-casting conversion? What is the process?

These are common questions companies just like yours look at to save money, gain a competitive advantage, improve reliability, present better branded and professional looking parts, and of course, improve their own customer's satisfaction.

In this Case Study, MMP will walk through the exact steps used, with a part from a new client as the example. From conception through the magic of melting metal to cleanup and testing, you can see for yourself the major hurdles in the not-so-simple process.

What triggers converting a weldment?

While every company and design engineer will have different goals and objectives, the most common are increased field reliability, lower cost, higher end user satisfaction, more professional appearance/branding, and simplicity/reduced parts count.

You can find many examples in the Research Report: W2C-011 "***Top 5 reasons Companies convert weldments to castings".***

How does the process begin?

Three ways:

1. Email AskTheMetallurgist@MidwestMetalProducts.com to arrange a phone call quick consultation.
2. Go to the website www.Weldment2Casting.com to download Research Papers or ask for a quote
3. Call the foundry directly at 507-452-7231 and ask to be connected to the Senior Metallurgist.

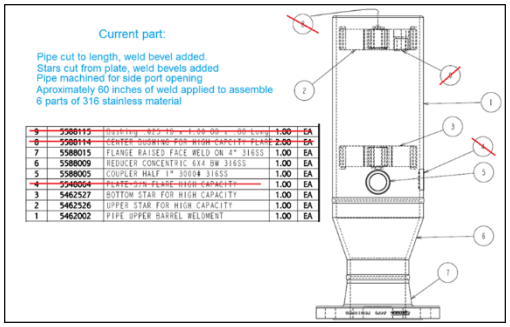
The Process

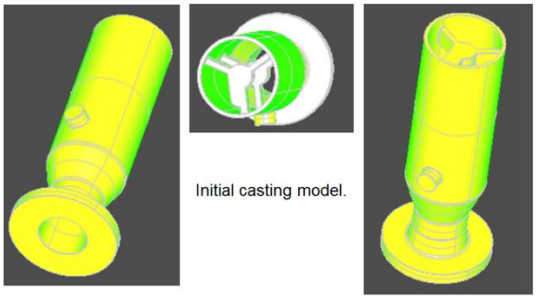
It's easy to show a before and after, such as this one here. But a lot of other work goes in between these two pictures.

This Case Study outlines the work process a metallurgist uses to ensure the new cast part exceeds a weldment in many ways. Mere before/after picture series cannot show that.

In the beginning…

MMP is the only foundry owned and operated by a metallurgist. This significant advantage starts with a review of the drawings for the weldment. In this case, the casting team identified parts that (1) could be eliminated or integrated into the casting, (2) improvements in design that would allow branding and part number incorporation, and (3) other critical elements that design engineers were able to change because of the flexibility of the casting process over the limitations of a weldment.



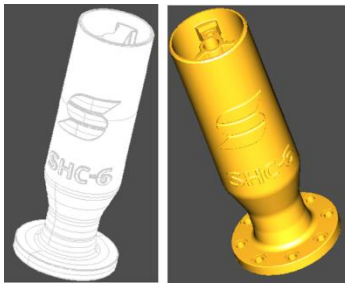


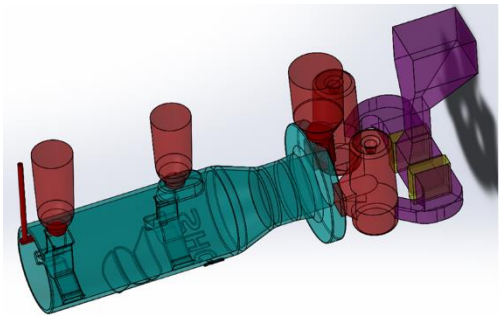
The work begins

Using in-house design and modeling expertise, the initial CAD drawings were constructed. These 3D modeling methods were the first real views of the finished product in rough shape, even though nothing had left the screen as of this point. But MMPs capability helped assure the client of the outcome long before any metal was poured. And the $1500 cost of this evaluation was covered by MMPs Zero Risk Weldment Conversion Evaluation Certificate, which you can download from our website.

Virtual finished part

The process continues with the incorporation of every detail of the finished part. In this picture the branding and part number are visible and the finish is now apparent. With client approval, the concept stage ends and the preparation for pouring metal begins. Up to this time, the work has been directed to top level design. From this point on, the 'Magic of Melting Metal' begins, as the pictures and drawings are converted to actual physical product

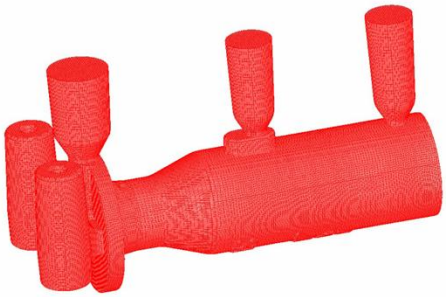




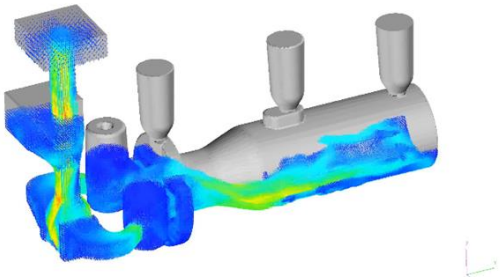
The complex process begins

Pouring metal is part science, part engineering, and part ‘dark arts’. While computer aided tools will help identify where to put pouring points and vents (called “sprues” and “risers” in the metallurgists world), the experience level of the team plays a significant role in getting it right the first time. What looks so pretty on the screen will be absolutely ugly when initially poured. More importantly, if the pour is not planned and engineered properly, the resulting metal will be scrap, a cost passed on to the buyer in some form. Lower scrap rates mean lower prices for you.

Solidification Analysis: Have you ever baked a cake?



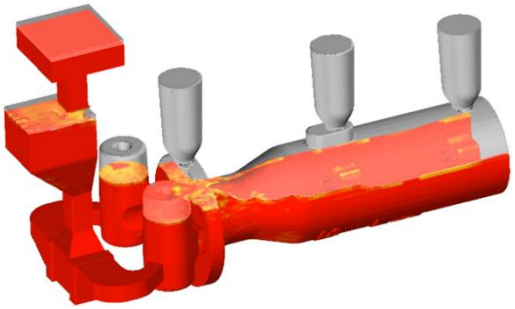
While this may seem like an odd question, it is very relevant. A critical element of baking a cake is testing to ensure it is finished or, in engineering terms, has solidified throughout the mixture. In a casting, this is modeled to ensure the molten metal, which could be as hot as 2700 degrees Fahrenheit or more, cools properly. If the metal is not poured properly, cracks or other defects could render the part useless. With over 700 variables to consider, this is where a metallurgist really makes money for their clients and customers. While some foundries spend their time trying to isolate and eliminate defects which cause scrap (which someone has to pay or…) we can continue to the next step.



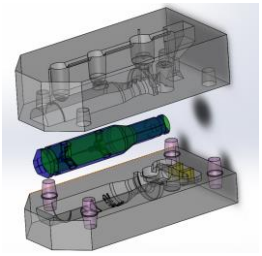
Flow Simulation- the two part story

Unlike pouring water into a bucket, molten metal has different properties. Combined with the limitation of the shape previously designed, a simulation program allows MMP to ensure the ‘lava’ of metal will fill the appropriate space without splashing around. The first step is to simulate the exact alloy and its flow pattern shown in blue here. You may have wondered what all the extra parts were protruding from the part, which seems barely visible in the picture. These are vents where air and metal will exit as the metal flows, properly placed by the experienced design team, these ensure each casting will be free from defects.

Flow Simulation Part Deux

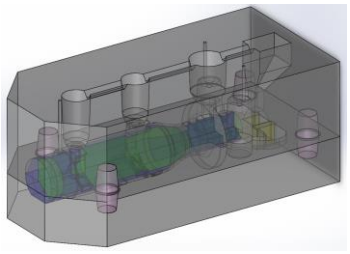


Just as important as how the metal flows is the temperature throughout the 'pour'. This is just another unseen step in the magic that few recognize looking at the finished part. Ever had a pancake burn on the outside before being cooked on the inside? While very few would model that cooking flow and temperature cycle, which is essentially what this step simulates to ensure nothing is 'half baked' which, like your pancake, has to be tossed.



Now the REAL work begins

The simulations have demonstrated the metallurgist team correctly identified and planned for each issue. Now it's time to begin construction of the actual molds and internal parts that will make the part. There are three essential parts you see here. The top and bottom form the mold cavity. But the part is not solid. So the 'core' must be constructed and inserted properly, not an easy task. Think of the core as being the 'air' in the finished part. Its role is to ensure that metal does ***not*** remain in certain areas of the finished part. (Do you like metallurgist lingo? The top part of the pair shown here is called the "cope", while the bottom piece is the "drag".)



Enough computer pictures, what does this look like?

Here is a picture of the mold. You can see the shape of the part clearly. And now you can see why a core or plug must be installed prior to pouring the metal. Without the core, the part would be completely solid.

Patternmakers- the artists at work

Creating cores requires a unique expertise that few people think about. A pattern maker must be able to translate the computer construction into actual pieces of core as shown in this series of pictures. When the price of a casting is considered, an initial cost is for the mold and cores. This investment will pay for itself over time and some clients will amortize the cost over the first few production runs and still see cost savings. MMP helps customer determine the best way to consider that investment- as a single payment or integrated into initial parts runs as the cost of the parts.

It's finally time to pour metal

All the planning, alloy selection, design work, simulation testing, mold and core construction- it all comes together in the next few minutes as the magic of melting metal comes to the creation of the part. What you don't see is the equipment that gathers, melts and pours. There is a lot that happens behind the curtain that isn't shown here. Is this dangerous? Just look at the safety equipment used by MMP's magicians. We take safety very seriously and our record is rarely matched by others. As the 'ladle' delivers the molten metal, all the efforts will now be tested. Was everything properly planned? While many foundries are 'hoping' everything will work out, MMP's metallurgist remains calm knowing his expertise will pay off soon when the part is revealed.

The work isn't over yet

After the cast has properly cooled, the part is broken out of the mold. Can you see its rough shape? It looks like the computer simulation drawings. There is still excess metal attached, part of the casting process. MMPs finishing experts will now get to work making this ugly duckling into a swan. Like a sculptor looking at a lump of marble, envisioning what needs to be removed to 'reveal the statue', it is now time to remove everything that isn't the finished part.

When the remaining parts of the mold have been removed, the part starts to take on the appearance of the finished product. Here it is much more visible, and will continue to be refined as shown in the following pictures.

Value added services

MMP offer several value added services and some of these were used in this example. Heat Treating, Machining, Painting, Assembly, Blanchard Grinding, and Sand Blasting or several of the options available. Several of these were used to save the client time and additional money. This delivers a 'ready-to-install' part instead of a number of castings requiring additional work by the company or end user.

Finally, the parts are assembled into the finished product for delivery to the client.

In conclusion

Cost determination

While we do not know if the company used Research Report W2C-007 "Determining true cost of weldments", that form is available to everyone and offers an 80% Quick Estimate as well as a 99.9% cost analysis sheet.

Based on this computation, your company then has a realistic baseline to help decide if the economics of the conversion meet your minimum requirements.

Branding improved

The professional appearance, clean lines, and embedded logo and part number all contribute to a much better perception of the brand. While some of this may appear to be emotional, perception is reality to your customers and clients. Which would you buy personally? A bunch of parts cobbled together and welded, or a smooth, single piece? Of course, the reliability and cost also amplify the choice but the eye is discerning. Parts that look professional are considered to have come from a professional source.

Summary

The process is not simple but the results can be economically advantageous, offer branding and reliability improvements, and several other benefits.

Working with a metallurgist directly can have a profound impact on the process and results.

Several important points should guide your decision making as you consider which weldments to convert to a high ROI casting:

A. MMPs risk free certificate takes away all costs associated with the evaluation

B. MMP, the only foundry owned and operated by a metallurgist, is uniquely experienced to get you the best value for your weldment to casting conversion.

C. While others may claim they can perform the same work without a metallurgist, this is like a foot doctor claiming he/she can do brain surgery because he is a 'doctor'. With 700+ variables in the foundry process, go to www.Weldment2Casting.com and download the Research Report W2C-007 *"How to select the best supplier for weldment-to-casting conversions"* to ensure you have a positive experience.

If you have any questions, feel free to go directly to our metallurgist using his email AskTheMetallurgist@MidwestMetalProducts.com .

Ready to get started? Here is your own certificate for a free, no cost, evaluation and consultation with our metallurgist. Just mention you are using the certificate when you make contact with the specialists at MMP.