DESIGNING WITHOUT BOUNDARIES

7 Steps to the Perfect Part

PMF Industries

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Thank you for your interest in our paper. Whether you're fresh out of school or an industry veteran of several decades, we feel you will find value in the process that we present here.

"Try not to limit your approach by your knowledge of what can be done by any one metalforming process..."

It is our effort to compile and present the experience we have gained during our 40 years of serving the industry.

In some cases, we pioneered new processes. In other cases we followed the lead of others. We have experienced trends and true innovation, and we have learned many things in the process.

We'd like to share this perspective with you.

Step 1 Assume anything is possible.

When you start from scratch to design a part, we suggest that you try not to limit your approach by your knowledge of what can be done by any one metalforming process or by the metalforming processes you have used in the past.

Why? Because there may be a new process or a combination of processes that will achieve your design objectives--ultimately without compromise.

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"Many parts with designed-in boundary lines could have been manufactured as a seamless component."

Step 2 Design your part, not the manufactured components.

Your first sketch of the part should include all the basic features and dimensions required without regard for boundary lines between what you perceive to be the components. It should look like a shadow image (like the image on an optical comparator that has been sectioned for viewing). This will help you and the manufacturing source to visualize the entire part or portions of it as seamless components. Yes, seamless is possible. Many parts with designed-in boundary lines could have been manufactured as a seamless component.

Consider the value of a seamless component. You undoubtedly understand structural advantages of removing a seam. However, there are many other advantages including the fact that it can be more cost-effective given the fact that many parts with welds or other seams are subject to very strict testing requirements such as radiography or pressure testing to ensure the safety of the part.

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"Learn to trust the expertise of your contractors."

Step 3 Collaborate early and often.

Provide some of your earliest sketches to your internal manufacturing staff or outside contractors to evaluate and provide suggestions. Learn to trust their expertise, and let them be the ones to add boundary lines where they feel they must be added. This will accomplish many things including:

It prevents you from "designing in" limitations based on your understanding of how the part should be manufactured.

It allows you to leverage the collective knowledge of all your metal working resources and contractors.

It expands the possibilities of how your parts are manufactured because you are not limiting it to the processes that you are familiar with or have used in the past.

It avoids the need for you (as a designer) to constantly research and monitor the latest metal working methods.

"The best solution often will be a combination of several different processes."

Step 4 Evaluate and select one or more proposals.

As the designer, you know the performance requirements for you part. And you are ultimately responsible for the design. The collaboration with your manufacturing people or outside contractors will result in manufacturing proposals that they feel will achieve the design and performance requirements that you presented. Realize that the best solution often will be a combination of several different processes, especially as the complexity of your part increases.

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"Keen observation and specific questions can reveal a lot about the quality you can expect."

"Demonstrate that you fully understand their manufacturing processes."

Step 5 Become comfortable with the proposals.

Before you fully commit to any manufacturing resource--internal or outsourced--you must have confidence that they can, in fact, achieve the proposed manufacturing approach. Ask them to provide the specific method or methods of manufacture that will be used. Visit their facility and ask to see parts similar to your design. And be sure to get a tour of their manufacturing facility.

Take this opportunity to really get to know their depth of knowledge, capabilities and experience. Keen observation and specific questions during that tour can reveal a lot about the quality you can expect from them.

Step 6 Take ownership of the design.

Once you are confident that you have found the right resource or combination of resources for your part, it is important to convert their proposals into your own design drawings and other specifications. This step is important to demonstrate to your resources--as well as to yourself--that you fully understand and "buy into" their manufacturing processes. Also, for liability reasons, most outside contractors will prefer to eventually quote against your specifications, even though their ideas are incorporated.

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Step 7 Establish Practical Expectations.

When all plans are completed, but before any manufacturing begins, confer with your resources to establish practical tolerances and other specifications for the part. Review the drawings and other specifications with your resources for the purpose of establishing the tolerances and specifications that will produce a part that is functional and least costly to produce.

Many of your decisions in this area will be influenced by your knowledge and comfort level with the processes offered by the manufacturing source. For example, if hard tooling in a press operation controls a certain dimension, it will most likely be repeatable once tooling is qualified. As such, you may not need to set a specific tolerance for it, but instead "reference" it as a "tool dimension." Conversely, if the dimension is controlled by an operation that has more variables, such as spinning, you may choose to set a specific tolerance differently. This is commonly achieved with an open plus or minus dimension.

"Setting tolerances is critical when using multiple resources."

Setting tolerances is critical when using multiple resources because the tolerances you set for the initial stages of the job will become the range of the starting point for "downstream" resources.

When all parties are comfortable with the tolerances of what they are to produce, you can confidently begin your manufacturing process.

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SUMMARY

If you follow these steps, you will create a design that meets several key aspects of any project:

1. It can be manufactured efficiently.
2. It is sourced to the most capable contractors.
3. It meets the form, fit and function that you intended.
4. All parties clearly understand the requirements for the part.

Through this process, you also will qualify your sources for manufacturing the part through your interactions and collaborations. But most importantly, you will have the personal satisfaction of knowing you removed the boundaries of preconceived ideas to design the perfect part.

PMF Industries is located in Williamsport, Pennsylvania
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