

# STEEL FOUNDERS' SOCIETY OF AMERICA

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## Product Development and First Article Qualification

Design and development of new steel castings to be used in modern equipment requires new tools and understandings. Many designers and purchasers have limited experience or knowledge about the capabilities and limitations of steel castings. SFSA has invested for a decade to provide tools and handbook like information and properties to enable high value use of steel castings in equipment, structural, and other applications. Much of this information is free and available online:

<https://www.sfsa.org/subject-areas/education/>

Success in maximizing the value for a new design requires close communication between the designer creating the component for performance and the manufacturer that understands the limits and opportunities of the production process. To avoid risk, many purchasers and designers depend on legacy practices for requirements and design. Many products are evolutionary designs to avoid risk and reduce cost.

An unfortunate path that is common is for the designer to consider consolidating multi-component assemblies into a single casting. This is the genesis of the giga casting for automotive frames at Tesla. This new design is risky so to ensure performance, strict requirements are imposed to ensure success. This proposed design with these requirements are then issued as an RFQ to see what the costs would be for the casting as designed and specified. This frequently results in mostly no quotes and quotes that are inordinately high. This approach is flawed, not allowing manufacturing to collaborate in both the design itself and the requirements to ensure performance.

An alternative approach that is patterned after Musk's approach at Tesla and SpaceX would take this initial concept and create a project with the most capable supplier to optimize cost and value.

*Designing the production system of a new product is at least an order of magnitude or two orders of magnitude harder than designing to initial prototype. In America, there's less importance placed on manufacturing and I think this is a mistake.* **Elon Musk, 2020 Air Warfare Symposium**

- Fix dumb requirements. Each requirement has a specific owner.
- Remove unnecessary parts.
- Simplify/Optimize.
- Speed up cycle time.
- Automate.

The way forward for you as purchasers and we as producers is to cut this Gordian knot of legacy practices and work together to optimize the casting design for production and performance. This requires that every feature, every requirement of the new design is up for discussion until the production path is established. It is never finally established but should continue to improve based on a continuous effort following the 5 rules.

A good approach for a promising new design using a steel casting is to create a part project in cooperation with the most qualified producer known. Allow them to critique the design and ask for changes. Every rejection of a proposed change should be made by the responsible person for that requirement and include their rationale. At this stage, alternative designs should be allowed and changes that include risk made. Additive manufacturing makes steel castings amenable to design iterations and alternative concepts.

Fail fast and fail often. Design and casting process alternatives should be evaluated to allow radical ideas to be tested. Designers should be able to predict the failure under testing and the components tested well beyond the design requirements to ensure the failure is known and reflects the understanding of the design requirements.

Short of this more radical approach to get the best value, new designs at a minimum should be developed as a project with a steel casting producer with their input. A useful approach is to make the prototype using the common commercial best practice and evaluate the performance. This allows the specifications and requirements to be simplified and reduce the cost of the product. Every requirement costs money. All costs must be borne by the purchaser or else the supplier will fail. The effort by the casting producer to reduce requirements is not to provide a lower quality part but to optimize the value.

This approach allows the new design to move forward with an honest evaluation of the value and producibility of the casting.

These approaches are also applicable to first article qualifications for existing products for a new producer. If the product is complex, the requirements stringent, and the purchaser is institutional, it is not clear that a steel casting producer can ever recover the cost of qualification and first article in future orders. With the challenging financial environment and past market conditions, steel casting producers do not have the resources or staff to put at risk in trying to qualify.

For foundries that are willing to fund and risk the prototyping and first article production on their own, this can provide them with the opportunity to enter new markets and gain customers. This also allows current suppliers at their own risk to reduce the schedule and risk for customers. Purchasers that have provided good support and business opportunities with producers can often get their foundry suppliers to collaborate on new designs development. But smaller foundries or those uncertain about their capabilities could be supported if the purchaser wants to attempt to develop them as a supplier.

Creating a system to financially support the new supplier to qualify and with some mechanism to ensure enough future business for the capable suppliers to recover their full costs for becoming and maintaining their qualifications will be essential to have a robust supply chain.



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