SECTION XI

ORDERING CASTINGS

1. Preliminary Design
2. Supplier Selection
3. Final Design
4. Formalize Quality Management System
5. Order Castings

Table 11.1 **Stages Involved in Ordering Castings.**

1. Does the foundry have a written policy stating its quality objectives?
2. Do the foundry's quality objectives include a strong commitment to quality and the continual improvement of quality?
3. Does the foundry have an operating quality system that commits and enables all foundry employees to meet the foundry's quality objectives?
4. Can the foundry demonstrate that its processes have the capability of producing castings consistently within specification?
5. Does the foundry use quality achievement tools such as FMEA and SPC to continually improve its process capabilities?
6. Does the foundry have an internal quality audit and evaluation system to ensure that all quality procedures are being followed?
7. Does the foundry have manuals defining all standard operating practices and quality procedures?
8. Does the foundry have a policy for periodically evaluating and updating all manuals to reflect current practices?

Table 11.2 **A checklist for evaluating the commitment of potential foundry partners to quality conformance and improvement.**

ORDERING CASTINGS

The process of ordering a casting should define and support the cooperative working relationship between customer and foundry leading to the development and production of castings which provide complete satisfaction to the end user and profit to both the customer and foundry.

Introduction

To survive and prosper in the face of intense international competition, manufacturers are adopting an innovative approach to product development that affects not only their own companies but also their casting suppliers. This new approach uses the concept of multifunctional, interactive team design to improve overall product quality and performance, reduce manufacturing costs, and shorten product development time. This concept also imposes a new role on foundries who are co-opted as partners into an extended, vertically integrated manufacturing system. In their new role as preferred suppliers, foundries must have the capability to not only supply quality assured products on time and at competitive cost, but also provide services that assist in the design, manufacturing and marketing of their customers' products.

The Ordering Process

In order to define and support the working partnership between customer and foundry, ordering castings has been changed from a simple commercial transaction to a multi-stage process that begins with the preliminary design of the casting and ends with qualification of the foundry for the production of commercial castings (Table 11.1).

Preliminary Design

The objective of this stage is to establish a sufficiently clear definition of the general performance requirements of the casting to permit a selection of candidate materials and production methods and to begin the definition of supplier performance standards. However, supplier selection should begin at the earliest possible point in the design process to take advantage of the expertise of the foundry partners.

Supplier Selection

Selecting the right foundry partner can be the most important part of the purchasing process. Many of the selection criteria depend on the customer's particular casting needs, but some of the most important criteria are assuming universal, and non-negotiable, status. The most important customer-specific criterion is the need for a good "fit" between the customer's requirements and the foundry's strengths. The need for "fit" is becoming more important as foundries become increasingly specialized in order to become the preferred supplier in targeted "niche markets". Categories in which fit is important are casting properties, production characteristics and foundry capability. Significant casting variables include size, complexity, dimensional accuracy, surface finish, composition and properties. Casting volume is one the more significant production variables. Critical foundry capabilities that can vary significantly according to market specialization include quality and cost control, production flexibility, expertise and customer service.

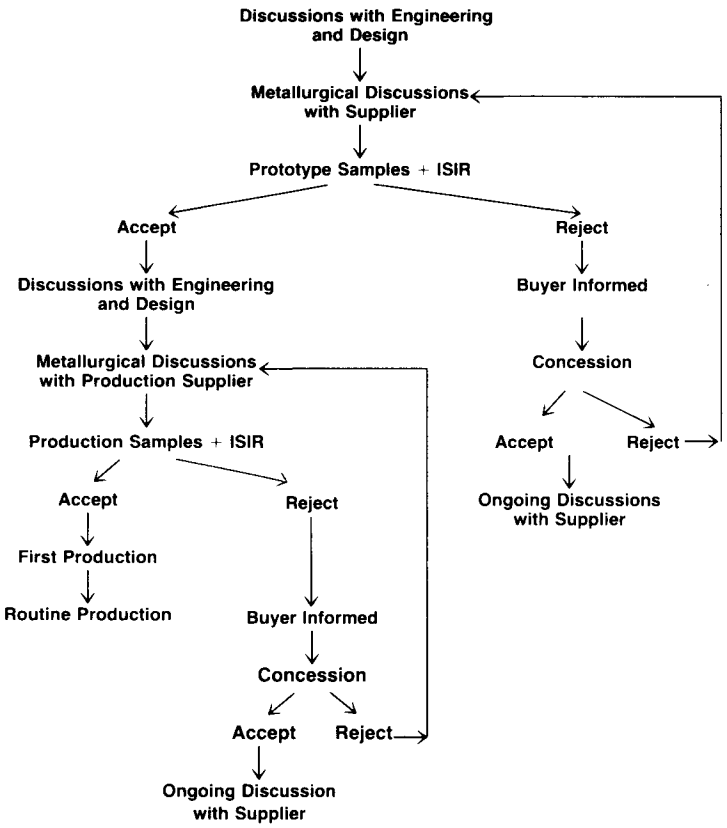


Figure 11.1 Casting design cycle leading to production of approved castings.

COST = PURCHASE PRICE + TOTAL MANUFACTURING COST

= PURCHASE PRICE + PRODUCTION COST + COST OF NONCONFORMANCE

= PURCHASE PRICE + PRODUCTION COST + COST OF SERVICE
+ COST OF LOST PRODUCTIVITY
+ COST OF SHIPPING REJECTS
+ COST OF PROCESS ADJUSTMENT
+ COST OF SCRAP & REWORK
+ COST OF ADMINISTRATION
+ COST OF DISTRACTION
+ COST OF REPUTATION

VALUE = QUALITY/COST

Table 11.3 The product value equation.

Conformance to quality and delivery requirements and competitive pricing are becoming universal and necessary criteria for supplier selection. Of these, the ability to meet quality requirements, and a commitment to continuous quality improvement are the most fundamental characteristics of a preferred supplier. These characteristics can be identified and evaluated with a supplier audit which follows the checklist shown in Table 11.2. The achievement of conforming and continuously improving quality enables the foundry to meet both quality and delivery requirements, offer competitive prices and provide other quality-related benefits such as increased manufacturability and component reliability.

"Competitive price" should be a significant but subordinate criterion for supplier selection. Awarding business to the lowest bidder, or using multiple suppliers to keep casting prices low is rarely a successful strategy to reduce production costs and increase component value. When price is given undue importance in the purchasing decision, the successful bidder often sacrifices casting quality and consistency. Similarly, when the multiple supplier strategy is used, inter-supplier variations reduce casting consistency. Thus, regardless of the method used, awarding business on purchase price alone will eventually lead to reduced casting consistency and process capability, increased production and nonconformance costs and decreased component quality. Although simplistic, the product value equations in Table 11.3 serve as a warning that minimizing casting purchase price may result in increased costs, decreased quality and decreased value of the finished product. As the value added to the casting by the customer increases, casting price becomes less important and the negative consequences of low casting quality become more dominant.

Final Design

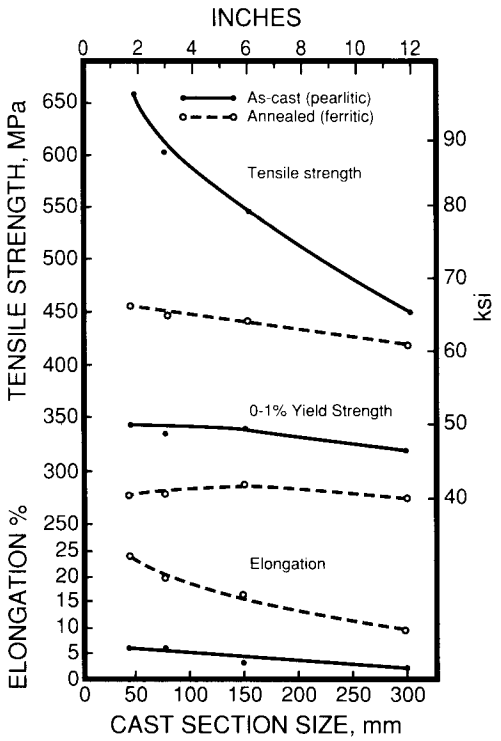
Final design is an iterative process involving close cooperation and liaison between the customer's design team and the foundry. As shown in Figure 11.1, the casting under development is cycled through successive design-feedback loops using first prototypes and then production samples until successful commercial castings are produced. After each successful design modification, operating plans are modified and appropriate conformance limits established. Although acting only as an advisor to the customer's design team, the foundry can play a critical role in optimizing casting performance and minimizing casting costs.

Final design activities should also include the cooperative efforts of both customer and foundry to reduce casting and manufacturing costs while maintaining or increasing product quality. Casting costs may be reduced by increasing overall process yield, reducing molding and coremaking costs, reducing casting cleaning costs and eliminating over-specification of the casting dimensions, composition and properties. Manufacturing cost may be reduced by increasing foundry process capabilities in dimensional and hardness control to reduce machining costs and redesigning the casting to simplify manufacturing procedures and increase productivity.

Formalizing Quality Management

This final step in the ordering process ensures that both the customer and foundry have clarified and defined all casting properties that are critical to manufacturability and product quality and have agreed upon appropriate quality assurance methodology. In this important area of specifying critical casting properties the foundry can play a very constructive role in pointing out the sensitivity of the mechanical properties to casting section size (Figure 11.2). This sensitivity to section size can be reduced significantly by employing high purity change materials, correct metal composition, special inoculation techniques, and methods to cool the section quicker.

Figure 11.2



Effect of casting section size on mechanical properties in heavy section castings.

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