

STEEL FOUNDERS' SOCIETY OF AMERICA

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Specifying Steel Castings

Steel castings offer custom solutions to product needs. They provide unique opportunities to use creative geometries and non-standard materials to gain performance and cost benefits, Steel castings can be made small and large, complex and simple, in lot sizes from ones to millions. Steel castings are almost all custom designs for single purchasers to provide proprietary requirements.

The ability to customize steel castings and provide the flexibility of geometry and material means that the purchaser needs to be able to specify the requirements needed for their part in a clear and efficient way. To purchase a steel casting, the purchaser typically provides a drawing or tooling to create the unique geometry for the part. This includes either a part drawing that the casting supplier uses to design the casting drawing and tooling or to provide the patterns and core boxes needed to make the part. The purchaser needs to specify the material for the casting and any testing required to qualify the part for delivery.

Steel casting geometry is commonly specified in a drawing. Tolerances for the steel castings are available on the SFSA website in [Supplement 3](#) utilizing ISO 8062 grades. Applying machining dimensions to all surfaces leads to added expense when the surface is not a mating area. This is made worse when a casting dimensional model is compared to a design solid model and discrepancies in unspecified areas are identified. SFSA has a [white paper](#) discussing these issues. Drawing notes may also have requirements that are not compatible with steel casting practices.

All the other requirements beyond the drawings and notes are usually included in the specifications cited in the purchase agreement. The organization of specifications in ASTM which is commonly used in purchasing steel castings imposes a range of requirements that are not obvious and which makes the steel casting acquisition easier. The ASTM specifications also included supplementary requirements that aid the purchaser in adding requirements necessary for their products.

For example, the most common grade of steel castings ordered is WCB. WCB as an alloy grade is included in ASTM A216. ASTM standards are developed by committees in consensus representing both the purchasers and suppliers of the products considered. The main committees are designated by a letter and the oldest committee is for steel, A. The standards are numbered in the order of development. For example the 6th standard developed for steel is still used and was most recently updated in 2016, ASTM A6-16. The oldest steel casting standard still active is for carbon steel, ASTM A27-16. Ordering WCB would be: ASTM A216-16 Grade WCB.

ASTM A216-16 Grade WCB requires that the heat meets the chemical compositional. Even though WCB is a carbon or unalloyed steel, to ensure that it is not alloyed and causes problems in welding or service, residual alloy elements are restricted. The steel casting standards were the first to restrict the residual alloy elements in carbon steels. When using the ASTM standards, the purchaser can further restrict the requirements but not relax them. A purchaser can obviously order anything he wishes but if he relaxes the requirements, the castings cannot be certified as meeting the ASTM requirements.

ASTM A216-16 Grade WCB also requires that the heat be capable of meeting the tensile properties specified. WCB properties for the heat are: ultimate tensile strength 70-95 ksi, yield strength 36 ksi,

elongation 22% and reduction in area 35%. This test is not to determine the properties in the casting but to qualify the steel from the heat. The relationship of the test bars from the heat to the castings is the subject of an SFSA white paper, [Test Coupon and Casting Properties](#).

ASTM steel casting standards have a number of common requirements that are not included in each standard but are gathered in a common requirements document. For common industrial applications, ASTM A781-14 is required. For A216 WCB, the common requirements are in ASTM A703-15 for pressure containing parts.

Ordering ASTM A216-16 Grade WCB also requires a visual inspection in paragraph 9 to ensure the casting is free of sand, scale or cracks. If a steel casting is ordered to ASTM grades, cracks are not permitted in any specification. Additional inspections can be ordered if needed. The purchaser can order radiographic testing RT or ultrasonic testing UT to ensure internal soundness. These can be ordered: RT- A703 S5 or UT- A703 S7. If the surface quality is critical the purchaser can order magnetic particle testing MT or liquid penetrant testing PT. These can be ordered: MT- A703 S4 or PT- A703 S6. When additional inspections are ordered, the purchaser should identify the parts of the casting to be inspected, the type inspection and the acceptance criteria required.

Welding in the supplier's plant is an ordinary part of steel casting production and is not restricted unless further specified by the purchaser ([welding white paper](#)). Welding on steel casting alloy grades must be done in accordance with ASTM A488-16. This requires that both the weld procedure and the welder be qualified. This is true of WCB A216 para. 10. Repair by Welding and by A703 para. 8. Repair by Welding. Purchasers can use A703 supplementary requirements to manage welding on their castings during production. ASTM A703-15 has supplementary requirements to examine the cavity prior to welding S10, for prior approval of major welds S12 and for weld repair charts S20.

A useful resource for purchasers considering steel castings is a free publication from SFSA, [Handbook Supplement 2](#)- Summary of Standard Specifications for Steel Castings. Questions can also be directed to SFSA, monroe@sfsa.org.



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