



## Selecting a Casting Specification

A number of industry-approved specifications cover most cast alloys. These specifications not only set the alloy chemistry and properties, but also establish metal quality standards for visual appearance, surface finish, soundness, weld repair, metal control, testing methods, minimum mechanical properties, crack inspection, heat treatment and many other details. In most cases, designers can use existing specifications when purchasing castings.

This update lists the ones in most frequent use and suggests ways in which they can be used. Depending on the particular part, however, supplemental drawing notes are often necessary to cover details not included in the specification.

### Casting Specifications Investment Casting Institute—"Commercial"

Castings with a safety factor exceeding 200% (those stressed far below their failure points) are usually purchased as "commercial quality," a term defined by *Basic Metal Quality Standards for Investment Castings* published by ICI. The BMQS is the most widely used standard and serves quite well for many applications. If a drawing only specifies something like "investment cast 420 HC steel, hardness 45-50 Rc," ICI members will use the BMQS quality standards to prepare the quote and process the castings.

Because Hitchiner processes commercial parts in the same plants that make parts to the more stringent specifications, the higher standards for internal controls and procedures carry over to the commercial applications. Thus, though Hitchiner may quote to the ICI standard, customers receive far more quality assurance than it requires. Field failures of Hitchiner parts due to casting defects are consequently rare.

### American Society for Testing Materials

Castings with a safety factor of about 150% (a smaller safety factor) should be made to the tighter metal part quality control and have the better inspection methods typical of ASTM specifications. These specifications are prepared by committees of both producers and users of castings and give more quality assurance than the commercial casting designation. The committees meet twice a year and issue revisions, the dates of which are added to the specifications; for example, A-732-89.

The list of alloys covered by the specifications is extensive; quality requirements are tailored to satisfy needs of the customer. Supplementary requirements in each specification can involve extensive testing. The foundry must guarantee the parts meet the specifications. Weld repair of casting defects by qualified welders (ASTM A-488) is permitted, but sometimes limited. The following sample of specifications (years not shown) shows the wide range of alloy coverage:

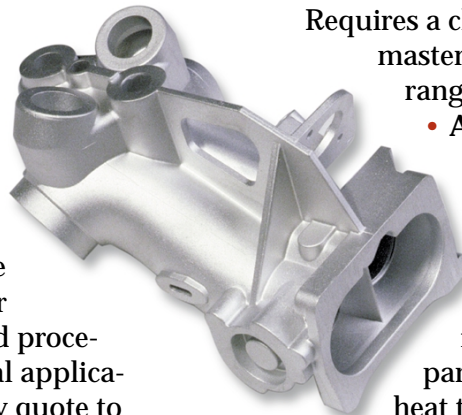
- **A-732:** Covers 15 different carbon and low alloy steels, heat treated to different grades. Can use this standard for Cobalt 21 and 31. Requires a chemical report of each heat or master heat. Parts must meet chemistry ranges when tested by the customer.
- **A-216:** Covers three carbon steel analyses for pressure-containing parts, suitable for weld assembly. Requires certification and heat treatment.
- **A-217:** Covers nine alloys for use in pressure-containing parts at high temperatures. Requires heat treatment and certification by each melt.
- **A-297:** Covers 14 grades of heat resistant stainless steels. All used as cast, certifications optional. Major weld repairs must be heat treated.



Rocker Arm  
Ferrous Division

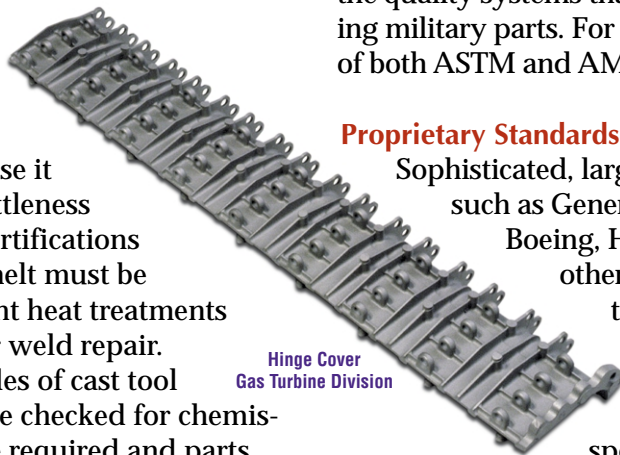


Golf Iron  
International Division



Motorcycle EFI Manifold  
Nonferrous Division

- **A-351:** Covers 24 grades of austenitic and duplex stainless steel grades for pressure containing parts. Certify by melt.
- **A-494:** Covers 14 nickel base alloys for corrosion resistant castings. Certification by melt is required. Requires sand or corrosion resistant shot blast or pickling. Matching chemistry for all welds.
- **A-747:** Covers two age-hardenable stainless steels, 17-4PH and 15-5PH. 15-5PH should generally be used because it is less susceptible to brittleness in heavy sections. No certifications are required, but each melt must be checked. Allows different heat treatments and heat treatment after weld repair.
- **A-597:** Covers nine grades of cast tool steels. Each melt must be checked for chemistry. Certification may be required and parts must be heat number- and alloy-identified.



Hinge Cover  
Gas Turbine Division

### US Military

MIL specifications and standards cover alloys (MIL-S-81591) as well as nondestructive test methods. They set some grades of metal quality (SAE AMS STD 2175) that a customer can specify depending on safety factor and part criticality. ISO-9000 and QS 9000 covers the requirements of the quality systems that are necessary for producing military parts. For many military parts, the use of both ASTM and AMS specifications is common.

### Proprietary Standards

Sophisticated, large users of special alloys such as General Electric, Pratt & Whitney, Boeing, Honeywell, and a few dozen others write their own specifications and procedures.

### Using Specifications

The use of so many specifications complicates the work of foundries—at one time there were 105 different chemical specification ranges for the common stainless steel alloy 17-4PH. Such diversity cannot always be justified; existing specifications should be used wherever possible. It is important to remember that the use of complex specifications with additional inspections is more costly, so let us help you select a specification that provides a satisfactory part at the lowest cost.

“**Ferrous and Nonferrous Vacuum and Air Melt Alloys,**” lists many of the alloys routinely cast at Hitchiner along with some common specifications. The list is partial; if you cannot find the alloy you are interested in, please contact the company for assistance. Hitchiner representatives can also show you hundreds of examples of parts made in these alloys.

### Advanced Specifications for Critical Applications

#### Society of Automotive Engineers

#### –Aerospace Material Specifications

Makers of parts for aerospace applications typically use these specifications. Committees of casting purchasers prepare and update them regularly. Each specification covers only one alloy, which is highly controlled and certified for chemistry, properties and various nondestructive testing procedures. They require sample submission and approval with no “significant” process changes after approval. Other AMS specifications cover methods of nondestructive testing and identification as supplements to the basic alloy specifications.

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