

Standards & Specifications

Like any other technology, engineering and science; material science and metallurgy is an ever-widening field with new developments rapidly burgeoning across the world, empowering better understanding of the nature and our earth as a whole. Conscientious research and development carried out in different countries is now giving way to new alloys that effectively, efficiently and economically, serve application needs of mankind. Most importantly, keeping into perspective, understanding our responsibility to preserve the environment from deterioration, and yet to accomplish goals that improve our lives.

With the ongoing research continuum, new alloys and materials standards, along with manufacturing standards keep coming up. With the globalisation of the world economy, growth in cross border business and trade in demanding people to work towards developing of a common platform based on consensus with their individual country standards, to form basis of manufacturing, inspection and acceptance criteria for products made in different countries. International Standards Organization (ISO) is emerging as a leading organization, which working in tandem with standard writing bodies of over 100 individual participating countries, in the diverse areas of engineering and technology, hence developing internationally accepted standards.

Though a number of other standards, and standard writing bodies come into perspective when one deals with ferrous and non-ferrous castings, the list given below is an example to tell our customers more about the standards that are commonly used in the manufacturing of castings and fully finished cast components. Many of the ISO standards for the newly developed ferrous and non-ferrous alloy castings are still being written, and are yet in working drafts format under the examining committee. These new standards are not as comprehensive and time tested as the older ones; for example, DIN (Germany), BIS (United Kingdom), ASTM (USA), Alloy Casting Institute (USA), ISI (India), ANFOR (France), to name a few. One only needs a superficial knowledge of a few of the existing steel casting specifications, and of metallurgy in general, to understand that stating what ones needs are is neither simple nor sinecure to manufacture.

“A problem well defined is half solved” – Anonymous

Some of the castings standards practiced by Acme Alloys are mentioned in the following sections. The list is neither complete nor comprehensive in any manner. Welding, machining, inspection, testing and other related standards, are excluded from this section to keep it simple. We are keen to work with customer's specified country standard and specifications. ISO, DIN, BS and the like casting standards are not mentioned but we do manufacture products confirming to them.

27/A 27M

Standard Specification for Steel Castings, Carbon, for General Applications

This specification covers carbon steel castings for general applications that require up to 70 ksi (485 MPa) minimum tensile strength

Grades

N-1, N-2, U-60-30, 60-30, 65-35, 70-36, 70-40

The grades covered by this specification represent materials that are suitable for assembly with other steel castings; or wrought grades possess the same degree of weld-ability or that the same welding techniques can be used on all castings.

A 128/ A 128M Standard Specification for Steel Castings, Austenitic Manganese

This specification covers Hadfield austenitic manganese steel castings and alloy modifications.

Grades

A, B-1, B-2, B-3, B-4, C, D, E-1, E-2, F

A 216/ A 216M Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, For High-Temperature Service

This specification covers carbon steel castings for valves, fittings, flanges, or other pressure-containing parts for high-temperature service and of quality suitable for assembly with other castings or wrought-steel parts by fusion welding.

Grades

WCA, WCB, WCC

Selection of these grades will depend upon design, and service conditions, mechanical properties, and the high temperature characteristics.

A 217/ A 217M Standard Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts, Suitable for High-Temperature Service

This specification covers martensitic stainless steel and alloy steel castings for valves, flanges, fittings and other pressure-containing parts intended primarily for high-temperature and corrosive service.

Grades

WC1, WC4, WC5, WC6, WC9, WC11, C5, C12, C12A, CA15

One grade of martensitic stainless steel and nine grades of ferritic alloy steel are covered. Selection will depend primarily on design and service conditions, mechanical properties, and the high-temperature and corrosion-resistant characteristics.

The grades covered by this specification represent materials that are suitable for assembly with other castings or wrought steel parts by fusion welding. It is not intended to imply that these grades possess equal degrees of weld-ability.

A 297/ A 297M Standard Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application

This specification covers iron-chromium and iron-chromium-nickel alloy castings for heat-resistant service. The grades covered by this specification are general-purpose alloys and no attempt intended, to include heat-resisting alloys that serve special production and end use specific application.

Grades

HF	19Cr-9Ni
HH	25Cr-12Ni
HI	28Cr-15Ni
HK	25Cr-20Ni
HE	29Cr-9Ni
HT	15Cr-35Ni
HU	19Cr-39Ni
HW	12Cr-60Ni
HX	17Cr-66Ni
HC	28Cr
HD	28Cr-5Ni
HL	29Cr-20Ni
HN	20Cr-25Ni
HP	26Cr-35Ni

A 351/ A 351M Standard Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts

This specification covers austenitic and austenitic-ferritic (duplex) steel castings for valves, flanges, fittings, and other pressure-containing parts.

A number of grades of austenitic and austenitic-ferritic steel castings are included in this specification. Since these grades possess varying degrees of suitability for service at high temperatures or in corrosive environments. Selection will depend on design and service conditions, mechanical properties, and high-temperature or corrosion-resistant characteristics, or both.

Grades

CF-3, CF-3A, CF-8, CF-8A, CF-3M, CF-3MA, CF-8M, CF-8MN, CF-8C, CF-10, CH-8, CH-10, CK-20, HK-30, HK-40, HT-30, CF-10MC, CN-7M, CN-3MN, CD-4MCu, CE-8MN, CG-8M, CF10S-MnN, CT-15C, CK-3MCuN, CE-20N, CG-3M, CD3M-WCuN

A 352/ A 352M Standard Specification for Steel Castings, Ferritic-Martensitic, for Pressure-Containing Parts, Suitable for Low-Temperature Service

This specification covers steel castings for valves, flanges, fittings, and other pressure-containing parts intended for low-temperature service.

Several grades of ferritic steels and one grade of martensitic steel are covered. Selection of analysis will depend on design and service conditions.

Grades

LCA, LCB, LCC, LC-1, LC-2, LC2-1, LC-3, LC-4, LC-9, CA-6NM

A 356/ A 356M Standard Specification for Steel Castings, Carbon, Low Alloy, and Stainless Steel, Heavy-Walled for Steam Turbines

This specification covers one grade of martensitic stainless steel and several other grades of ferritic steel castings for cylinders (shells), valve chests, throttle valves, and other heavy-walled castings for steam turbine applications.

Grades

1, 2, 5, 6, 8, 9, 10, 12, CA-6NM

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A 389/ A 389M Standard Specification for Steel Castings, Alloy, Specially Heat-Treated, for Pressure-Containing Parts, Suitable for High Temperature Service

This specification covers alloy steel castings, which have been subjected to special heat treatment, for valves, flanges, fittings and other pressure-containing parts intended primarily for high-temperature service.

The high-temperature properties of the materials covered in this specification are dependent upon special heat treatment that is required. Although the high-temperature properties are not specified, they are implied by control of chemistry, heat treatment, and room temperature properties.

Grades

C23

C24

The above two grades of ferritic alloy steel are covered. The grades covered by this specification represent materials that are generally suitable for assembly with other castings or wrought steel parts by fusion welding. It is not intended to imply that these two grades possess equal degrees of weldability. In addition, these two grades possess varying degrees of suitability for resistance to oxidation and for high-temperature service.

A 439/ A 439M Standard Specification for Austenitic Ductile Iron Castings

This specification covers austenitic ductile iron castings (Ni-Resist), which are primarily used for their resistance to heat, corrosion, and wear, and for other special purposes.

Grades

D-2, D-2B, D-2C, D-3, D-3A, D-4, D-5, D-5B, D-5S

Austenitic ductile iron, also known as austenitic nodular iron or austenitic spheroidal iron, is characterized by having its graphite substantially in spheroidal form and prominently free of flaked graphite. It contains some carbides and sufficient alloy content to produce an austenitic microstructure.

A 447/ A 447M Standard Specification for Steel Castings, Chromium-Nickel-Iron Alloy (25-12 Class), for High Temperature Service

This specification covers iron-base, heat-resistant alloy castings of the 25% chromium, 12% nickel class, intended for structural elements, containers, and supports in electric furnaces, petroleum still tube supports, and for similar applications up to 1095°C (2000°F). The buyer should inform us when the service temperatures are to exceed 980°C (1800°F).

In the absence of significant proportions of elements, the two types of alloys covered by this specification may in general be distinguished as follows:

Type I - Alloys characterised by relatively low limiting creep stress at temperatures between 815°C and 1095°C (1500°F and 2000°F), and relatively high ductility at ordinary temperatures after aging for short periods at temperatures between 705°C and 815°C (1300°F and 1500°F)

Type II - Alloys have relatively high limiting creep stress but may develop low ductility at ordinary temperatures when aged for short periods at temperatures between 730°C and 815°C (1350°F and 1500°F)

A 487/ A 487M Standard Specification for Steel Castings, Suitable for Pressure Service

This specification covers low-alloy steels and martensitic stainless steels in the normalized and tempered, or quenched and tempered, condition suitable for pressure containing parts. The weld-ability of the classes in this specification varies from readily weld-able to weld-able only with adequate precautions, and the weld-ability of each class should be considered prior to assembly by fusion welding.

<u>Grades</u>	<u>Class</u>	<u>Type</u>
1	ABC	V
2	ABC	Mn-Mo
4	ABCDE	Ni-Cr-Mo
6	AB	Mn-Ni-Cr-Mo

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7	A	Ni-Cr-Mo-V
8	ABC	Cr-Mo
9	ABCDE	Mo
10	AB	Ni-Cr-Mo
11	AB	Ni-Cr-Mo
12	AB	Ni-Cr-Mo
13	AB	Ni-Mo
14	A	Ni-Mo
16	A	Low carbon Mn-Ni
CA15	ABCD	Martensitic Cr
CA15M	A	Martensitic Cr
CA6NM	AB	Martensitic Cr-Ni

A 494/ A 494M Standard Specification for Castings, Nickel and Nickel Alloy

This specifications covers nickel, nickel-copper, nickel-copper-silicon, nickel-molybdenum, nickel-chromium, and nickel-molybdenum-chromium alloy castings for corrosion-resistant service.

Grades

CZ-100, M-35-1, M-35-2, M-30H, M-25S, M-30C, N-12MV, N-7M, CY-40, CW-12MW, CW-6M, CW-2M, CW-6MC, CY-5SnBiM, CX-2M, CU-5MCuC

A 518/ A 518M Standard Specification for Corrosion-Resistant High-Silicon Cast Iron Castings (Metric)

This specification covers high-silicon cast irons castings intended for corrosion-resistant service.

Grades

1, 2, 3

Selection of the grade depends on the corrosive service to be experienced by the casting or the cast part/component. All the three grades are suited for application in severe corrosive environments. However, Grade 2 is particularly suited for application in strong chloride environments and Grade 3 is recommended for impressed current anodes.

A 532/ A 532M Standard Specification for Abrasion-Resistant Cast Irons

This specification covers a group of white cast irons that have been alloyed to secure high resistance to abrasion wear in the applications of the mining, milling, earth-handling and manufacturing industries. Simple and low-alloy white irons that consist essentially of iron carbides and pearlite are specifically excluded from this specification.

Grades

<u>Class</u>	<u>Type</u>	<u>Designation</u>
I	A	Ni-Cr-Hc
I	B	Ni-Cr-Lc
I	C	Ni-Cr-GB
I	D	Ni-HiCr
II	A	12% Cr
II	B	15% Cr-Mo
II	D	20% Cr-Mo
III	A	25% Cr

A 560/ A 560M Standard Specifications for Castings, Chromium-Nickel Alloy

This specification covers chromium-nickel alloy castings intended for heat-resisting and elevated-temperature corrosion application such as structural members, containers, supports, hangers, spacers, and the like in corrosion environments up to 1090°C (2000°F).

Grades

50Cr-50Ni
60Cr-40Ni
50Cr-50Ni-Cb/Nb

A 703/ A 703M Standard Specifications for Steel Castings, General Requirements, for Pressure-Containing Parts**A 732/ A 732M** Standard Specifications for Castings, Investment, Carbon and Low Alloy Steel for General Application, and Cobalt Alloy for High Strength at Elevated Temperatures

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This specification covers carbon and low-alloy steel castings used in investment casting process. Fifteen grades of steel and two cobalt alloy grades are covered.

<u>Grades</u>	<u>Type</u>
1A	Low carbon (IC 1020)
2A, 2Q	Medium carbon (IC 1030)
3A, 3Q	Medium carbon (IC 1040)
4A, 4Q	Medium carbon (IC 1050)
5N	Vanadium (IC 6120)
6N	Manganese Molybdenum (IC 4020)
7Q	Chromium Molybdenum (IC 4130)
8Q	Chromium Molybdenum (IC 4140)
9Q	Chrome Nickel Molybdenum (IC 4330)
10Q	Chrome Nickel Molybdenum (IC 4340)
11Q	Nickel Molybdenum (IC 4620)
12Q	Chromium Vanadium (IC 6150)
13Q	Chrome Nickel Molybdenum (IC 8620)
14Q	Chrome Nickel Molybdenum (IC 8630)
15A	Chromium (IC 52100)
21	Cobalt
31	Cobalt

A 743/ A 743M Standard Specifications for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application

This specification covers iron-chromium and iron-chromium-nickel alloy castings in general corrosion-resistant application. The grades covered by this specification represent types of alloy castings suitable for broad ranges of application that are intended for a wide variety of corrosive environments.

<u>Grades</u>	
CF-8	19Cr-9Ni
CF-12	22Cr-12Ni
CF-20	19Cr-9Ni
CF-8M	19Cr-10Ni-Mo
CF-8C	19Cr-10Ni-Nb
CF-16F	19Cr-9Ni Free machining
CF-16Fa	19Cr-9Ni Free machining
CH-10	25Cr-12Ni

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CH-20	25Cr-12Ni
CK-20	25Cr-20Ni
CE-30	29Cr-9Ni
CA-15	12Cr
CA-15M	12Cr
CB-30	20Cr
CC-50	28Cr
CA-40	12Cr
CA-40F	12Cr Free machining
CF-3	19Cr-9Ni
CF-10SMnN	17Cr-8.5Ni with Nitrogen
CF-3M	19Cr-10Ni with Molybdenum
CF-3MN	19Cr-10Ni with Molybdenum & Nitrogen
CG-6MM	
CG-3M	19Cr-11Ni with Molybdenum
CN-3M	
CN-3MN	21Cr-24Ni with Molybdenum & Nitrogen
CN-7M	20Cr-29Ni with Copper & Molybdenum
CN-7MS	19Cr-24Ni with Copper & Molybdenum
CA-6NM	12Cr-4Ni
CA-6N	11Cr-7Ni
CA-28MWV	12Cr with Molybdenum, Tungsten & Vanadium
CK-3MCuN	20Cr-18Ni with Copper & Molybdenum
CK-35MN	23Cr-21Ni with Molybdenum & Nitrogen
CB-6	16Cr-4Ni

A 744/ A 744M Standard Specifications for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Application

This specification covers iron-chromium-nickel alloy, stainless steel castings for particularly severe corrosion applications.

Grades

CF-8	19Cr-9Ni
CF-8M	19Cr-10Ni with Molybdenum
CF-8C	19Cr-10Ni-Nb
CF-3	19Cr-9Ni
CF-3M	19Cr-10Ni with Molybdenum
CG-3M	19Cr-11Ni with Molybdenum
CN-7M	20Cr-29Ni with Copper & Molybdenum
CN-7MS	19Cr-24Ni with Copper & Molybdenum

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CN-3MN 21Cr-24Ni with Molybdenum & Nitrogen
CK-3MCuN 20Cr-18Ni with Copper & Molybdenum

A 747/ A 747M Standard Specifications for Steel Castings, Stainless, Precipitation Hardening

This specification covers iron-chromium-nickel-copper corrosion-resistant steel castings, capable of being strengthened by precipitation hardening heat treatment.

Grades

CB7Cu-1
CB7Cu-2

These castings may be used in service requiring corrosion resistance and high strengths at temperatures up to 315°C (600°F). They may be machined in the solution-annealed condition and subsequently precipitation hardened to the desired high-strength mechanical properties, with little danger of cracking or distortion. The material is not intended for use in the solution-annealed condition.

A 781/ A 781M Standard Specifications for Castings, Steel and Alloy, Common Requirements, for General Industrial Use

A 915/ A915M Standard Specifications for Steel Castings, Carbon and Alloy, Chemical Requirements Similar to Standard Wrought Grades

This specification covers carbon and low alloy steel castings having chemical analysis similar to that of the standard wrought grades.

Grades

SC 1020
SC 1025
SC 1030
SC 1040
SC 1045
SC 4130
SC 4140
SC 4330

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SC 4340

SC 8620

SC 8625

SC 8630

A 958/ A 958M Standard Specification for Steel Castings, Carbon, and Alloy, with Tensile Requirements, Chemical Requirements Similar to Standard

This specification covers carbon and low alloy steel castings having chemical analysis similar to that of the standard wrought grades.

Grades

SC 1020

SC 1025

SC 1030

SC 1040

SC 1045

SC 4130

SC 4140

SC 4330

SC 4340

SC 8620

SC 8625

SC 8630