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Products | Alloys | Carbon Steels

Carbon Steels

Carbon Steels contain only carbon as the principal alloying element. Other elements are present in small quantities, including those added for de-oxidation. Silicon and manganese in cast carbon steels typically range from 0.25% to about 0.80% Si, and add about 0.50% to about 1.00% Mn. Carbon steels can be classified according to their carbon content into three broad groups:

Low-carbon steels: less than or equal to 0.20% C

Medium-carbon steels: 0.20% to 0.50% C

High-carbon steels: more than or equal to 0.50% C

Low alloy steels contain alloying elements, in addition to carbon, up to a total content of 8%. Cast steels containing more than the following amounts of a single alloying elements are considered low-alloy cast steels: Mn 1.00%, Si 0.80%, Ni 0.50%, Cu 0.50%, Cr 0.25%, Mo 0.10%, V 0.50% and W 0.50%. Acme Alloys manufactures low, medium and high carbon steel castings and custom made fully finished components, meeting your application needs.

Some Representative Standard Plain Carbon Steel Specifications

AISI Number	%C	%Mn	%P(max)	%S(max)
C1010	0.80-0.13	0.30-0.60	0.04	0.50
C1015	0.13-0.18	0.30-0.60	0.04	0.50
C1020	0.18-0.23	0.30-0.60	0.04	0.50
C1025	0.22-0.28	0.30-0.60	0.04	0.50
C1030	0.28-0.34	0.60-0.90	0.04	0.50
C1035	0.32-0.38	0.60-0.90	0.04	0.50
C1040	0.37-0.44	0.60-0.90	0.04	0.50
C1045	0.43-0.50	0.60-0.90	0.04	0.50
C1050	0.48-0.55	0.60-0.90	0.04	0.50
C1055	0.50-0.60	0.60-0.90	0.04	0.50
C1060	0.55-0.65	0.60-0.90	0.04	0.50
C1065	0.60-0.70	0.60-0.90	0.04	0.50
C1070	0.65-0.75	0.60-0.90	0.04	0.50
C1074	0.70-0.80	0.50-0.80	0.04	0.50
C1080	0.75-0.88	0.60-0.90	0.04	0.50
C1085	0.80-0.93	0.70-1.00	0.04	0.50
C1090	0.85-0.98	0.60-0.90	0.04	0.50
C1095	0.90-1.03	0.30-0.50	0.04	0.50

Modern Steel Making Process

Acme Alloys employs AC and DC electric-arc furnace (EAF) process technology to manufacture carbon steels and micro-alloyed carbon steels, with close composition control. In this process,

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adjustable electrodes are lowered to a point just above a selected, sorted and hand picked charge of steel scrap at room temperature. Potential difference is applied across the electrodes and an electric arc is struck between the electrodes, resulting in melting of steel.

We apply reducing atmosphere for producing special alloy steels, which contain an appreciable amount of easily oxidized alloying elements such as chromium, tungsten, and molybdenum. The electric-arc furnace (EAF) process is also used to produce very low sulphur and phosphorous levels that are vital in some alloy steels and the process, also provides careful temperature control.

Ladle Metallurgy & Argon Oxygen Decarburization (AOD)

Backed up with more than 20 years of experience and expertise in high alloy metallurgy of the parent company, AcmeCast; Acme Alloys now provides its international customers, valued added products in high-quality refined alloys for superior performance with reduced down times and enhanced product life resulting in lower life-cycle costs.

In the 1990's, considerable improvements has been made by us, in our products compared to that in the 1980's, by employing ladle or secondary metallurgy. By applying these refining techniques considerable amount of valuable steel making time and fluxes are now saved, while reducing atmospheres effected better control over some of the refining process like desulphurisation. In the mid-1990's we began the use of argon-oxygen-nitrogen lancing practice popularly known an Argon-Oxygen Decarburization (AOD), to manufacture superior quality cast products, which enabled us to achieve the following

- **Improved temperature control.** By using submerged heating electrodes or aluminium additions, the steel temperature can be easily increased to the ideal temperatures.
- **Composition homogenisation.** By stirring the molten metal by argon gas, the chemical composition of the steel can be made more homogenous.
- **Improved de-oxidation.** Closer control can be obtained for de-oxidizing the molten steel by just adding enough aluminium to remove oxygen. For de-oxidation of carbon and low alloy steels, aluminium, titanium, tantalum and zirconium are used. Unless otherwise specified, the normal sulphur limit of carbon and low-alloy steels is 0.60%; the normal phosphorous limit is 0.50%.
- More efficient methods' can be applied to add alloying additions and to control the final chemical composition of the steel.
- **De-sulphurization.** By using reducing conditions with a synthetic cover slag in the ladle, sulphur contents can be reduced to very low levels and inclusions can be floated to the surface of the steel into the slag.
- The **shape of the remaining sulphide and oxide inclusions can be controlled** by calcium and rare earth additions.

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Heat Treatment

Heat treatment is an important step in the production of steel castings because it develops the mechanical properties of hardenable steel. All cast carbon steel products are subjected to a heat treatment specific to its alloy composition, part geometry and properties desired at end-application. Several types of heat treatment processes - annealing, normalizing, quenching, tempering, stress relief and hydrogen removal, are available. The essential elements of any heat treatment are the heating cycle and the cooling cycle. The length of the time that a casting is held at temperatures and the cooling rate are important factors. The holding time or the soaking time is kept long enough at appropriate temperatures to complete the desired micro structured - transformation as well as retention.

Applications

Low-carbon cast steels have elements present in low-carbon cast steel, other than carbon. They are manganese (0.50 to 1.00%), silicon (0.25 to 0.80%), and sulphur and phosphorous (up to 0.05% maximum each). Residual elements such as nickel, chromium, copper, molybdenum will be present in small amounts. Cast carbon steels containing less than 0.10% C are mainly produced for electrical and magnetic equipment and are normally given full-anneal treatment. Some castings in the railroad industry are produced from low-carbon cast steel. Castings for the automotive industry are also produced from this class of steel, as are annealing boxes and hot metal ladles. Steel castings in this class are also produced for case carburizing, by which process the castings are given a hard wear-resistant exterior and tough, ductile core.

The **medium-carbon cast steels** represent the bulk of steel casting production, which is heat-treated by normalizing. These castings are used in wide variety of ways, including application in the railroad and other transportation industries, machinery and tools, equipment for rolling mills, mining, and construction equipment and many other miscellaneous applications.

High carbon cast steels are used in applications that relatively high strength levels.

Ref: ASTM Standards - Iron & Steel Products, Volume 01.02 Ferrous Castings
ISO & DIN Standards - Iron & Steel Castings – 77.140.80